Vol. 11, No. 6
March 31, 1986

Energy Research Abstracts

Abstracts 10735-12527

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Office of Scientific and Technical Information; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Office of Scientific and Technical Information, U. S. Department of Energy, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize legislative, regulatory, and other legal aspects, as well as social, economic, and environmental impacts. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price is $72.00 for domestic (North America) or $90.00 for foreign (outside North America) subscribers; a single issue is $5.00 or $6.25, respectively.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price for the 24 issues is $146.00 for domestic (North America) subscribers or $182.50 for foreign (outside North America) subscribers. A single issue is $14.00 or $17.50, respectively.

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available (use PB86-946800) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual price is $18.00 for domestic (North America) or $36.00 for foreign (outside North America); a single issue is $9.00 or $18.00, respectively.

Energy Meetings (EM)

A monthly listing of conferences, symposia, workshops, etc., pertaining to DOE's programmatic interests. *EM* is available on subscription (use PB86-901500) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $45.00 for domestic subscribers and $90.00 for subscribers outside the North American continent; a single issue is $5.00 and $10.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription price (12 issues plus cumulative index) is $85.00 for domestic (North America) and $170.00 for foreign (outside North America) subscribers; a single issue is $8.00 and $16.00, respectively.

***Current Energy Patents (CEP)*–PB86-902800.** International patent literature, including patent applications, on any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB86-914900.** Impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB86-914600.** The exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB86-915300.** Information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB86-914500.** The utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $45.00 for domestic (North America) and $90.00 for foreign (outside North America) subscribers; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB86-901000.** Acid precipitation, including effects and possible control measures.

***Buildings Energy Conservation (BEC)*–PB86-900700.** Technology required for energy conservation in buildings of all types.

***Coal-Based Synfuels (CBS)*–PB86-901400.** Conversion of coal into gaseous or liquid fuels.

***Coal Combustion and Utilization (CCU)*–PB86-914400.** Coal combustion, including fluidized bed combustion, and direct utilization of coal for power generation, fuel cells, and MHD generators.

***Coal Preparation and Pollution Control (CPC)*–PB86-900800.** Coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB86-946600.** Photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Energy from Biomass (EFB)*–PB86-900600.** Biomass production, conversion, and utilization for energy.

***Geothermal Energy Technology (GET)*–PB86-914700.** Exploration, development, and utilization of geothermal resources.

***Heavy-Ion Reactions (HIR)*–PB86-900500.** Heavy-ion ($A > 4$) reactions.

***Laser Research (LAR)*–PB86-901100.** Laser research and development, excluding applications.

***Nuclear Fuel Cycle (NFC)*–PB86-913400.** Both front and back ends of the nuclear fuel cycle.

***Nuclear Reactor Safety (NRS)*–PB86-913500.** Accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB86-902900.** Management aspects of transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB86-901200.** Research and development of efficient and reliable solar thermal conversion systems.

***Transportation Energy Research (TER)*–PB86-900900.** Energy-efficient advanced automotive propulsion systems and transportation energy conservation.

***Unconventional Petroleum (UCP)*–PB86-901300.** Secondary and tertiary recovery of petroleum and oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information (OSTI) cooperates in the publication of international abstract journals with the following: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts;* and (3) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts.* In each case, the cognizant foreign agency provides the non-U. S. information to OSTI for inclusion in the Energy Data Base; in turn, OSTI provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information on the conversion of biomass to energy. *Biomass Abstracts* is available free to DOE components and contractors from OSTI. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to DOE components and contractors from OSTI. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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Vol. 11, No. 6
ISSN: 0160-3604
CODEN: ERABD
March 31, 1986

ENERGY RESEARCH ABSTRACTS

ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, OSTI places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, OSTI builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to OSTI's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of OSTI's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Office of Scientific and Technical Information has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications; OSTI also serves as adviser for special publication needs of the Department. To effectively manage DOE's technical information resources, OSTI's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $146.00 for domestic subscribers and $182.50 for foreign subscribers. A single issue costs $14.00 (domestic) or $17.50 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

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United States Department of Energy, P. O. Box 62, Oak Ridge, TN 37831

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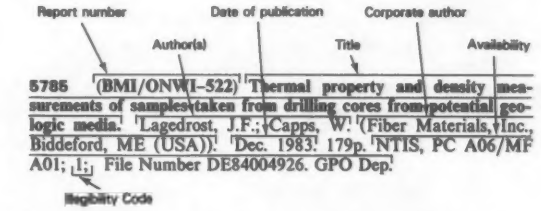
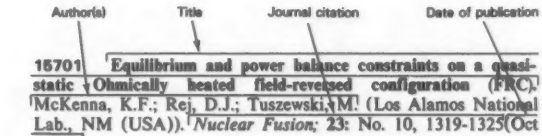
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; File Number DE84004926. GPO Dep.
Legibility Code

Abstract

Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325(Oct 1983).

Abstract

Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830 **Fiber Materials, Inc., Biddeford, ME (USA)** 9:5785 BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A file number–report number correlation is included for convenience.

BMI/ONWI-522 9:5785 NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70

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Foreign Sources

CEA Centre d'Etudes de Saclay
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Fachinformationszentrum
Energie, Physik, Mathematik GmbH
Karlsruhe, Federal Republic of Germany

IEA Biomass Conversion Service
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Knoxville, TN

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 39 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semi-monthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6 from NTIS for $9.50.

01 COAL AND COAL PRODUCTS
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Legislation and Regulations

02 PETROLEUM
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

03 NATURAL GAS
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Aspects
- 09 Artificial Stimulation
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

04 OIL SHALES AND TAR SANDS
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

05 NUCLEAR FUELS
- 01 Reserves
- 02 Exploration
- 03 Mining
- 04 Feed Processing
- 05 Enrichment
- 06 By-Products
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing and Economics
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Regulations

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies

08 HYDROGEN
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

09 OTHER SYNTHETIC AND NATURAL FUELS
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste and Wood Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power-Conversion Systems

14 SOLAR ENERGY
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Systems
- 07 Solar Thermal Power Systems
- 08 Ocean Energy Systems
- 09 Solar Thermal Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

15 GEOTHERMAL ENERGY
- 01 Resource Status and Assessment
- 02 Geology and Hydrology of Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 07 By-Products
- 08 Geothermal Power Plants
- 09 Geothermal Engineering
- 10 Direct Energy Utilization
- 20 Geothermal Data and Theory

16 TIDAL AND WAVE POWER
- 03 Regulations
- 04 Economics

16 TIDAL AND WAVE POWER (CONT.)

05 Environmental Aspects
07 Tidal Power Plants
08 Wave Energy Converters

17 WIND ENERGY

01 Availability (Climatology)
03 Regulations
04 Economics
05 Environmental Aspects
06 Wind Energy Engineering

20 ELECTRIC POWER ENGINEERING

01 Power Plants and Power Generation
02 Environmental Control Technology
03 Power Transmission and Distribution

21 NUCLEAR POWER PLANTS

01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
03 Power Reactors, Non-Breeding, Graphite Moderated
04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
05 Power Reactors, Breeding
06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
07 Regulation and Licensing
08 Economics
09 Process Heat Reactors

22 NUCLEAR REACTOR TECHNOLOGY

01 Theory and Calculation
02 Components and Accessories
03 Fuel Elements
04 Control Systems
05 Environmental Aspects
06 Research, Test, and Experimental Reactors
07 Plutonium and Isotope Production Reactors
08 Propulsion Reactors
09 Reactor Safety

25 ENERGY STORAGE

01 Magnetic
02 Compressed Gas
03 Pumped Hydro
04 Capacitor Banks
05 Flywheels
06 Thermal
07 Liquefied Gas
08 Chemical
09 Batteries

29 ENERGY PLANNING AND POLICY

01 Energy Analysis and Modeling
02 Economics and Sociology
03 Environment, Health, and Safety
04 Natural Resources
05 Research, Development, Demonstration, and Commercialization
06 Nuclear Energy
07 Transport and Storage
08 Waste Heat Utilization
10 Conservation
20 Supply, Demand, and Forecasting
30 Policy, Legislation, and Regulation
40 Fossil Fuels
50 Hydrogen and Synthetic Fuels
60 Electric Power
80 Consumption and Utilization
90 Unconventional Sources and Power Generation

30 DIRECT ENERGY CONVERSION

01 MHD Generators
02 EHD Generators
03 Thermoelectric Generators
04 Thermionic Converters
05 Fuel Cells
08 Miscellaneous Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

01 Buildings
02 Transportation
03 Industry and Agriculture
06 Municipalities and Community Systems
09 Education and Public Relations

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

01 Internal Combustion Engines
02 External Combustion Engines
03 Electric-Powered Systems
04 Hybrid Systems
05 Flywheel Propulsion
06 Vehicle Design Factors
07 Emission Control
08 Alternative Fuels

36 MATERIALS

01 Metals and Alloys
02 Ceramics, Cermets, and Refractories
03 Composite Materials
04 Polymers and Plastics
06 Other Materials

40 CHEMISTRY

01 Analytical and Separations Chemistry
02 Inorganic and Physical Chemistry
03 Organic Chemistry
04 Electrochemistry
05 Photochemistry
06 Radiation Chemistry
07 Radiochemistry and Nuclear Chemistry
08 Combustion Pyrolysis, and High-Temperature Chemistry

42 ENGINEERING

01 General Engineering
02 Facilities and Equipment
03 Lasers
04 Heat Transfer and Fluid Flow
05 Materials Testing
06 Safety Engineering
07 Vacuum Engineering
08 Electronic Circuits and Devices
09 Waste Processing Plants and Equipment
10 Combustion Systems
20 Underground Engineering
30 Marine Engineering
40 Pollution Control Equipment
50 Power Cycles

43 PARTICLE ACCELERATORS

01 Design, Development, and Operation
02 Beam Dynamics, Field Calculations, and Ion Optics
03 Auxiliaries and Components
04 Storage Rings

44 INSTRUMENTATION

01 Radiation Instrumentation
02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
03 Miscellaneous Instruments
04 Well Logging Instrumentation

45 EXPLOSIONS AND EXPLOSIVES

01 Chemical
02 Nuclear
03 Explosion Detection

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

01 Basic Studies
02 Chemicals Monitoring and Transport
03 Radioactive Materials Monitoring and Transport
04 Thermal Effluents Monitoring and Transport
05 Site Resource and Use Studies
06 Regulations

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

01 Basic Studies
02 Chemicals Monitoring and Transport
03 Radioactive Materials Monitoring and Transport
04 Thermal Effluents Monitoring and Transport
05 Site Resource and Use Studies
06 Regulations

52 ENVIRONMENTAL SCIENCES, AQUATIC

01 Basic Studies
02 Chemicals Monitoring and Transport
03 Radioactive Materials Monitoring and Transport
04 Thermal Effluents Monitoring and Transport
05 Site Resource and Use Studies
06 Regulations

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

01 Social and Economic Studies
02 Assessment of Energy Technologies
03 Environmental Impact Statements

55 BIOMEDICAL SCIENCES, BASIC STUDIES

01 Behavioral Biology
02 Biochemistry
03 Cytology
04 Genetics

55 BIOMEDICAL SCIENCES, BASIC STUDIES (CONT.)
05 Metabolism
06 Medicine
07 Microbiology
08 Morphology
09 Pathology
10 Physiological Systems
20 Public Health
30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
01 Radiation Effects
02 Thermal Effects
03 Chemicals Metabolism and Toxicology
04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES
01 Geology and Hydrology
02 Geophysics
03 Mineralogy, Petrology, and Rock Mechanics
04 Geochemistry
05 Oceanography

64 PHYSICS I
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

65 PHYSICS II
10 Nuclear Physics
40 Radiation and Shielding Physics
50 Medical Physics
60 Solid-State Physics
61 Superconductivity
70 Theoretical Physics
80 Mathematical Physics
90 Communication, Education, History, and Philosophy

70 FUSION ENERGY
01 Plasma Research
02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
01 Management
02 Mathematics and Computers
03 Information Handling
04 Law
05 Civilian Defense

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

FILE NUMBER CORRELATION

SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 39 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semi-monthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6 from NTIS for $9.50.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 08 Alternative Fuels
- 03 Electric-Powered Systems
- 07 Emission Control
- 02 External Combustion Engines
- 05 Flywheel Propulsion
- 04 Hybrid Systems
- 01 Internal Combustion Engines
- 06 Vehicle Design Factors

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 03 Chemicals Metabolism and Toxicology
- 04 Other Environmental Pollutant Effects
- 01 Radiation Effects
- 02 Thermal Effects

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 30 Agriculture and Food Technology
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 06 Medicine
- 05 Metabolism
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 08 Combustion Pyrolysis, and High-Temperature Chemistry
- 04 Electrochemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry

01 COAL AND COAL PRODUCTS
- 05 By-Products
- 40 Combustion
- 09 Environmental Aspects
- 60 Health and Safety
- 70 Legislation and Regulations
- 50 Marketing and Economics
- 20 Mining
- 04 Processing
- 06 Properties
- 10 Reserves and Exploration
- 30 Transport and Handling
- 08 Waste Management

30 DIRECT ENERGY CONVERSION
- 02 EHD Generators
- 05 Fuel Cells
- 01 MHD Generators
- 08 Miscellaneous Converters
- 04 Thermionic Converters
- 03 Thermoelectric Generators

20 ELECTRIC POWER ENGINEERING
- 02 Environmental Control Technology
- 01 Power Plants and Power Generation
- 03 Power Transmission and Distribution

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 09 Education and Public Relations
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 02 Transportation

29 ENERGY PLANNING AND POLICY
- 10 Conservation
- 80 Consumption and Utilization
- 02 Economics and Sociology
- 60 Electric Power
- 01 Energy Analysis and Modeling
- 03 Environment, Health, and Safety
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 04 Natural Resources
- 06 Nuclear Energy
- 30 Policy, Legislation, and Regulation
- 05 Research, Development, Demonstration, and Commercialization
- 20 Supply, Demand, and Forecasting
- 07 Transport and Storage
- 90 Unconventional Sources and Power Generation
- 08 Waste Heat Utilization

25 ENERGY STORAGE
- 09 Batteries
- 04 Capacitor Banks
- 08 Chemical
- 02 Compressed Gas
- 05 Flywheels
- 07 Liquefied Gas
- 01 Magnetic
- 03 Pumped Hydro
- 06 Thermal

42 ENGINEERING
- 10 Combustion Systems
- 08 Electronic Circuits and Devices
- 02 Facilities and Equipment
- 01 General Engineering
- 04 Heat Transfer and Fluid Flow
- 03 Lasers
- 30 Marine Engineering
- 05 Materials Testing
- 40 Pollution Control Equipment
- 50 Power Cycles
- 06 Safety Engineering
- 20 Underground Engineering
- 07 Vacuum Engineering
- 09 Waste Processing Plants and Equipment

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport

52 ENVIRONMENTAL SCIENCES, AQUATIC (CONT.)
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements
- 01 Social and Economic Studies

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 03 Explosion Detection
- 02 Nuclear

70 FUSION ENERGY
- 02 Fusion Power Plant Technology
- 01 Plasma Research

99 GENERAL AND MISCELLANEOUS
- 05 Civilian Defense
- 03 Information Handling
- 04 Law
- 01 Management
- 02 Mathematics and Computers

58 GEOSCIENCES
- 04 Geochemistry
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 05 Oceanography

15 GEOTHERMAL ENERGY
- 07 By-Products
- 10 Direct Energy Utilization
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 02 Geology and Hydrology of Geothermal Systems
- 20 Geothermal Data and Theory
- 09 Geothermal Engineering
- 03 Geothermal Exploration and Exploration Technology
- 08 Geothermal Power Plants
- 04 Legal and Institutional Aspects
- 01 Resource Status and Assessment

57 HEALTH AND SAFETY

13 HYDRO ENERGY
- 05 Economics and Management
- 06 Environmental Aspects
- 03 Plant Design and Operation
- 07 Power-Conversion Systems
- 04 Regulations and Licensing
- 01 Resources and Availability
- 02 Site Geology and Meteorology

08 HYDROGEN
- 07 By-Products
- 09 Environmental Aspects
- 06 Industrial and Commercial Use
- 04 Marketing and Economics
- 01 Production
- 08 Properties
- 05 Safety
- 02 Storage
- 03 Transport

44 INSTRUMENTATION
- 03 Miscellaneous Instruments
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 01 Radiation Instrumentation
- 04 Well Logging Instrumentation

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 03 Isotopic Power Supplies
- 01 Physical Isotope Separation
- 02 Radiation Sources

36 MATERIALS
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 01 Metals and Alloys
- 06 Other Materials
- 04 Polymers and Plastics

03 NATURAL GAS
- 09 Artificial Stimulation
- 40 Combustion
- 03 Drilling, Production, and Processing
- 08 Environmental Aspects
- 02 Geology and Exploration
- 05 Health and Safety
- 10 Legislation and Regulation
- 06 Marketing and Economics
- 04 Products and By-Products
- 30 Properties
- 01 Reserves
- 50 Storage
- 20 Transport, Pipelines, and Handling
- 07 Waste Management

05 NUCLEAR FUELS
- 06 By-Products
- 05 Enrichment
- 30 Environmental Aspects
- 02 Exploration
- 04 Feed Processing
- 07 Fuels Production and Properties
- 40 Health and Safety
- 10 Marketing and Economics
- 03 Mining
- 50 Regulations
- 01 Reserves
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 20 Waste Management

21 NUCLEAR POWER PLANTS
- 08 Economics
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 05 Power Reactors, Breeding
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 09 Process Heat Reactors
- 07 Regulation and Licensing

22 NUCLEAR REACTOR TECHNOLOGY
- 02 Components and Accessories
- 04 Control Systems
- 05 Environmental Aspects
- 03 Fuel Elements
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety
- 06 Research, Test, and Experimental Reactors
- 01 Theory and Calculation

04 OIL SHALES AND TAR SANDS
- 06 Direct Uses and By-Products
- 03 Drilling, Fracturing, and Mining
- 10 Environmental Aspects
- 07 Health and Safety
- 08 Marketing and Economics
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 20 Regulations
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 09 Waste Research and Management

09 OTHER SYNTHETIC AND NATURAL FUELS
- 02 Alcohol Fuels
- 06 Gaseous Waste Fuels
- 01 Hydrocarbon Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 05 Liquid Waste Fuels
- 04 Solid Waste and Wood Fuels

43 PARTICLE ACCELERATORS
- 03 Auxiliaries and Components
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 01 Design, Development, and Operation
- 04 Storage Rings

02 PETROLEUM
- 50 Combustion
- 03 Drilling and Production
- 09 Environmental Aspects
- 02 Geology and Exploration

02 PETROLEUM (CONT.)
06 Health and Safety
10 Legislation and Regulation
07 Marketing and Economics
04 Processing
05 Products and By-Products
30 Properties
01 Reserves
40 Storage
20 Transport, Pipelines, and Handling
08 Waste Management

64 PHYSICS I
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

65 PHYSICS II
90 Communication, Education, History, and Philosophy
80 Mathematical Physics
50 Medical Physics
10 Nuclear Physics
40 Radiation and Shielding Physics
60 Solid-State Physics
61 Superconductivity
70 Theoretical Physics

14 SOLAR ENERGY
03 Economics
04 Environmental, Legal, and Institutional Aspects
20 Heat Storage
08 Ocean Energy Systems
06 Photovoltaic Power Systems
01 Resources and Availability
10 Solar Collectors and Concentrators
05 Solar Energy Conversion
07 Solar Thermal Power Systems
09 Solar Thermal Utilization

16 TIDAL AND WAVE POWER
04 Economics
05 Environmental Aspects
03 Regulations
07 Tidal Power Plants
08 Wave Energy Converters

17 WIND ENERGY
01 Availability (Climatology)
04 Economics
05 Environmental Aspects
03 Regulations
06 Wind Energy Engineering

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

FILE NUMBER CORRELATION

ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 10819

10735 **(DOE/ET/17086—1932) Proceedings of the low-rank coal technology development workshop.** (Energy Resources Co., Inc., Cambridge, MA (USA)). Feb 1982. Contract AC01-80ET17086. 518p. (CONF-8106235—). NTIS, PC A22/MF A01; 1; GPO Dep. File Number DE86000823.

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

The technology development needs of US low-rank coals were discussed in a two-day workshop attended by coal R and D experts from government research facilities; private sector research, engineering, and vendor firms; the utility industry; and academia. Six parallel workshop sessions, with 12 to 21 participants each, addressed six different technology areas: (1) preparation, handling, and storage, (2) conventional combustion, (3) environmental control technology, (4) fluidized bed combustion, (5) gasification, and (6) liquefaction. R and D recommendations were made by the workshop groups, emphasizing unresolved technical problems associated with the distinctive physical and chemical properties of lignite and subbituminous coals. Twenty-two articles have been entered individually into EDB and ERA.

0104 Processing

REFER ALSO TO CITATION(S) 10805, 10808, 10809, 10851, 10884, 10920, 10927, 10928, 11122, 11140, 11142, 11397, 11552, 11674

10736 (DOE/ET/17086—1932, pp 5.1-5.27) **Gasification.** Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

The fourteen participants in the Gasification Workshop included six representatives from private sector research, engineering, or vendor firms, three representatives from government research facilities, three from industry - or utility-sponsored research institutes, one from a coal gasification project sponsor, and one from academia. The background statements which had been prepared on the agenda topics were used as a starting point for the discussion. Table 5-1 lists the agenda topics and indicates the prepared presentations that were given to initiate discussions. Each of the proposed research topics was discussed at the workshop, and a consensus was reached as to the need for further research in each of the topics. Some of the original research topics were dropped and others were added in the course of the discussions. At the close of the discussions, all of the agreed-upon research topics were rated as either higher or lower priority. The research topics, with priority rankings, are listed in Table 5-2.

10737 (DOE/ET/17086—1932, pp 5.33-5.58) **Catalytic Coal Gasification Process Development Unit operation.** Euker, C.A. Jr.; Wesselhoft, R.D. Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

The Exxon Catalytic Coal Gasification (CCG) Development Program began in July, 1978 and is a coordinated effort involving bench scale R and D, operation of a one-ton-per-day Process Development Unit (PDU), and engineering support. This work is aimed at advancing the catalytic coal gasification technology through the development stage to make it ready for further scale-up in a large pilot plant. One of the major objectives of the program is to demonstrate the feasibility of the integrated process which includes gasification, gas separation, and catalyst recovery. This integrated system is operated at commercial design conditions feeding bituminous Illinois No. 6 coal catalyzed with potassium hydroxide. This operation will demonstrate the feasibility of the catalytic coal gasification process in integrated operation and will ready the technology for scale-up to the larger pilot plant stage. The conceptual commercial CCG process will be defined. Exxon funded pilot plant results and predevelopment work funded by the Department of Energy and completed in 1977 have been reported previously. This paper presents results obtained during a recently completed contract with DOE for development of the process in a 40 kg/h (one-ton-per-day) Process Development Units (PDU). Portions of the development work in the PDU have been reported previously. 12 refs., 18 figs.

10738 (DOE/ET/17086—1932, pp 5.59-5.69) **Research on wastewater treatment and reuse for coal gasification and liquefaction.** Luthy, R.G.; Dzomback, D.A.; Campbell, J.R. (Carnegie-Mellon Univ., Pittsburgh, PA). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

Investigations are in progress to evaluate wastewater treatment technologies and reuse strategies for coal conversion wastewaters. This work includes the following: (1) Experimental studies to assess removals of major and trace organic contaminants during bench-scale treatment of coal gasification wastewaters. (2) Development of predictive techniques for assessing the fate of organic contaminants during wastewater treatment. This work emphasizes model development for predicting water-solvent distribution coefficients for organic contaminants during solvent extraction. (3) Assessment of water reuse strategies for coal liquefaction facilities under constraints of no discharge of treated water. This work is directed towards evaluation of techniques for reducing raw water withdrawal, lowering wastewater treatment costs, and minimizing residual brine which must be disposed. Specific research activities in each of these areas are described. This work is a continuation of previous studies regarding treatment of coal gasification process wastewaters. Previous work has included several investigations of biological treatment of coal gasification wastewaters, including evaluation of biological removal of specific organic contaminants and effects of addition of powdered activated carbon (PAC) to activated sludge reactors. Studies have also been performed to provide information on use of reverse osmosis for wastewater demineralization. 25 refs.

10739 (DOE/ET/17086—1932, pp 6.1-6.21) **Liquefaction.** Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

The seventeen participants in the Liquefaction Workshop included six representatives from government research facilities, four representatives from private sector research, engineering, or vendor firms, and seven representatives from academia. The background statements which had been prepared on the agenda topics were used as a starting point for the discussion. Table 6-1 lists the agenda topics prepared prior to the meeting. Each of the proposed research topics was discussed at the workshop, and a consensus was reached as to the need for further research in each of the topics. Some of the original research topics were dropped and others were added in the course of the discussions. At the close of the discussions, all of the agreed-upon research topics were rated as either

higher or lower priority. The revised listing of research topics, with priority rankings, is given in Table 6-2.

10740 (DOE/ET/17086—1932, pp 6.23-6.35) **LRC liquefaction reducing gas composition and moisture effects product yield, quality and operability.** Willson, W.G.; Knudson, C.L.; Baker, G. (Grand Forks Energy Technology Center, ND). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

Liquefaction research at GFETC was initiated in 1975 to support the development of the CO-Steam process, named for the reaction of carbon monoxide and steam with coal. Emphasis on CO-Steam work was shifted toward the production of distillate product as a means of avoiding the problem of solids separation. Batch experiments had demonstrated that higher temperatures coupled with shorter residence times were effective in reducing the molecular weight of the heavy ends without an unacceptable production of gaseous hydrocarbons if the vehicle solvent had suitable H-donor properties. Because of the emphasis on recycling and on raising temperatures, which required a good hydrogen donor solvent, the work was seen to offer direct support for application of the SRC II and Exxon Donor Solvent processes to lignite. The following conclusions are reported: (1) Distillate yields on an MAF basis obtained from lignite using either synthesis gas or hydrogen were as high as from bituminous coal if bottoms recycle was employed. (2) Recycle operation was observed to equalize the distillate yield from different coals. (3) Some process water either from inherent lignite moisture or water injection downstream of the reactor was necessary for lignite processing to prevent ammonium carbonate precipitation even with pure H_2S. (4) In situ slurry drying or reactor operation with at least half of the inherent lignite moisture retards the formation of deposition of calcium carbonate within the reactor. (5) Reducing gas consumption expressed as hydrogen equivalents is about the same for synthesis gas or hydrogen at 4 to 6 wt % of the MAF coal. (6) Satisfactory unit operations and product yields can be obtained by using either synthesis gas or hydrogen with lignite at pressures below 3000 psig. 8 refs., 3 figs., 2 tabs.

10741 (DOE/MC/14593—1981) **Sodium chloride as a catalyst for the gasification of coal char. Final report, Tasks 8 and 9.** Wood, B.J.; Brittain, R.D.; Tong, G.T.; Wise, H. (SRI International, Menlo Park, CA (USA)). Dec 1985. Contract AC21-80MC14593. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86001047.

This project examined the feasibility of using sodium chloride to promote the rate of production of low- and medium-Btu gas by steam gasification of coal, char, or other carbonaceous materials. The objectives of the study were to develop this process and elucidate its mechanism. Our experimental measurements confirm that, in the presence of carbon, sodium chloride can react with water to yield hydrogen chloride in concentrations substantially greater than the equilibrium level. The other product of hydrolysis, sodium hydroxide, should remain on the carbon phase as an active steam gasification catalyst. In process optimization experiments, however, we found that treatment of sodium chloride-impregnated char in flowing steam produces only a modest enhancement in the gasification reactivity of the material. Illinois No. 6 coal char and Spheron-6 mineral-free carbon black respond identically to the treatment. The method of addition of sodium chloride to the char appears to be quite unimportant. The use of carbon dioxide as a gaseous additive during the steam pretreatment substantially augments the efficacy of the catalyst activation process, but only for the mineral free carbon. In the case of NaCl-char admixtures, mineral constituents in the char may interfere with the activation process. It appears that a suitable steam-carbon dioxide treatment of sodium chloride-impregnated carbon can raise the catalytic activity of the additive to a level near that of sodium carbonate. The cost per mole of sodium in salt brine is less than 10% that of sodium carbonate. Consequently, sodium chloride has potential for use as a disposable catalyst that would significantly reduce the cost and enhance the attractiveness of catalytic coal gasification. 8 refs., 7 figs., 4 tabs.

10742 (DOE/MC/16433—1977) **Dynamic simulation of entrained coal gasification.** Cheng, S.I. (Cooper Union Research Foundation, New York (USA)). 1983. Contract AC21-81MC16433. 116p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86001045.

A multistage dynamic computer model has been developed for the simulation of the performance of entrainment coal gasification. The model provides for the calculation of such pertinent factors as reaction rates, physical properties of solids and gases, transport coefficients, devolatilization, effect of the type of reactor, etc. The profiles of rate-variables such as gas mixture and particle temperatures, carbon conversion, and gas composition, were tracked against time of operation by numerical integration. After a great deal of time has been consumed to assure the stability of the program, efforts were spent to compare the simulated results with experimental data both from Homer City, Pennsylvania for the Bigas reactor and from Mountain Fuels, Utah. 13 refs., 16 figs., 15 tabs.

10743 (DOE/METC—85/5, pp 548-554) **Utilization of non-mineable coal - a new approach of German coal industry.** Knoblauch, K.; Hewing, G.; Witte, P. (Studiengesellschaft Kohlegewinnung Zweite Generation, Essen, West Germany). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The Federal Republic of Germany disposes of hard coal reserves at great depths which are considered as non-mineable according to the present state of the art and which are several times as large as mineable reserves. To ensure safe long-term energy and raw material supplies on the basis of domestic resources, possibilities to utilize these coal reserves must be studied. With these objectives the German coal industry together with several research and development organization and university institutes have made a new approach by establishing a research association called Studiengesellschaft Kohlegewinnung Zweite Generation e.V. which means unconventional coal recovery. This Association is to initiate, coordinate and implement basic research in the field of underground coal conversion to point out realizable development paths. The work will in the first place center on methods converting coal into a transportable, i.e. gaseous, liquid or fluidized product by in situ conversion. The long-term objective is the development of in situ processes to provide for the utilization of non-mineable hard coal. As a first step the association now has implemented a fundamental and systematic experimental study on coal properties. This study will run over 4 years with a financial budget of about 10 million DM. The paper mainly deals with this study and describes details of the research program.

10744 (DOE/METC—85/5, pp 11-25) **Results of the Centralia underground coal gasification field test.** Hill, R.W.; Thorsness, C.B.; Cena, R.J.; Stephens, D.R. (Lawrence Livermore National Lab., CA). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—). Contract W-7405-ENG-48.

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

This article reviews the results of the Centralia Partial Seam CRIP (PSC) test. The PSC test was conceived to provide technical data needed to further evaluate the economic potential of underground coal gasification (UCG) at this site, as well as enhance the general knowledge concerning the UCG process. The design and specifications of the field test is discussed; giving information on geology of the coal seam, injection well spacing, and well angles. The results of the test show the quality of gas generated and the different phases of generation during the UCG process.

10745 (DOE/METC—85/5, pp 43-53) **Status of the joint Belgo-German experiment of underground coal gasification.** Patigny, J.; Li, T.K.; Chandelle, V.; Sonntag, C.; Fabry, R.; Kurth, M. (Institution pour le Development de la Gazeification Souterraine, Liege, Belgium). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

This article reviews the current status of a Belgo-German trial project which is attempting to create an underground gas generator which can operate at a pressure of 20 to 30 bar. It discusses the results of reverse combustion experiments and the problems of self-ignition of the coal in the vicinity of the injection well. It also discusses the problems of creating a linking channel between wells and extensive well maintenance problems which exist.

10746 (DOE/METC—85/5, pp 54-65) **Description and status of the Byrne Creek power project.** Humphrey, A.E.; Bahrke, W.H. (Energy Investment Corp., New York, NY). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The Byrne Creek Power Project will be the first commercial application of UCG in the US. Energy Investment Corporation of New York and Dravo Constructors, Inc., of Pittsburgh have joined together as equity sponsors for the project. Loan and price guarantees have been requested from the US Synthetic Fuels Corporation. The project is to be located on private land about 15 miles northeast of Evanston, Wyoming, using coal resources owned by Rocky Mountain Energy Company, a subsidiary of Union Pacific Corporation. The facility is designed to generate 31.6 megawatts of power for sale of Utah Power & Light Co. Medium-Btu gas will be fired in a gas turbine unit to supply power for sale and for internal plant use. A general overview of the project status, organizational structure, economics, design, and schedule are presented.

10747 (DOE/METC—85/5, pp 66-78) **UCG tests at la Haute-Deule - first results.** Gadelle, C.; Lessi, J.; Marrast, J.; Pottier, M.; Raffoux, J.F.; Sarda, J.P.; Ternot, A. (Institut Francais du Petrole, Rueil-Malmaison). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The GEGS (Study Group on Underground Coal Gasification) has scheduled for 1984 a trial on underground gasification of deep coal on the Haute-Deule site. The 2 m thick coal seam lies at a depth of approximately 880 m. Two wells 60 m apart were drilled and linked by hydraulic fracturing (with sand propping using nitrogen foam). On the basis of preliminary laboratory and site tests, the site has been equipped for ignition, reverse combustion and gasification operations. Coal ignition is planned for May 1984 and the reverse combustion phase should last about 2 months. If the results are satisfactory, a limited amount of coal will be gasified by means of an oxygen-steam mixture. The full results obtained before Summer 1984 are presented.

10748 (DOE/METC—85/5, pp 92-96) **Proven directional drilling techniques tested in Texas lignite.** O'Donnell, H.W. (Spie Horizontal Drilling, Inc., Houston, TX). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Directional drilling techniques and equipment developed and successfully employed in hundreds of horizontally drilled pipeline river crossings over the last decade are field tested in a Texas lignite test program. The drilling equipment and newly developed survey methods produce fast and economical means to drill from the surface, controlled horizontal boreholes into thin coal seams (4-8 feet) at depths on the order of 1000 feet. Distances up to 2000 feet are easily attainable to precisely intercept vertical bores for underground coal gasification purposes. The paper discusses the problems, solutions and cost of an actual field test of a prototype drilling program utilizing rapid jet drilling, specialized drill rig, and a new directional measurement method to ensure precision intersections of horizontal and vertical boreholes. Recommendations on improved procedures learned from the field test are presented.

10749 (DOE/METC—85/5, pp 130-133) **Preliminary results of postburn coring and drilling at WIDCo-CRIP UCG experimental test site, Centralia, Washington.** Dana, G.F.; Covell, J.; Oliver, R.L.; Elliott, J.R. (Western Research Institute, Laramie, WY). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—). Contract FC21-83FE60177.

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

A postburn drilling and coring program was conducted at the WIDCo-CRIP underground coal gasification test site near Centralia, Washington. The objective of the program was to delineate the region of the coal and overburden affected by the gasification test and to provide subsurface information for process analysis. Nineteen holes were drilled. Six were drill holes, four were a combination of drill and core holes, and nine were core holes. Various geophysical surveys were run on each hole. Subsurface samples of coal, overburden, and products of the gasification were recovered as drill cuttings and cores. As a result of the program, void volume and the affected regions of the coal and overburden were delineated. Results from a thermocouple and material balance analysis compared reasonably with the drilling results; however, the controlled source audio frequency magnetotelluric (CSAMT) and seismic surveys did not. Substantial roof collapse occurred in only one area near the second injection point. The drilling and coring results indicate approximately 1750 cubic meters of coal were affected.

10750 (DOE/METC—85/5, pp 136-147) **WIDCO Partial Seam CRIP test: impact of gas characteristics on processing requirements.** Kilpatrick, M.P.; Paul, R.A. (Radian Corp., Austin, TX). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Radian Corporation collected and analyzed samples of raw product gas particulate and condensate during the Partial Seam CRIP Underground Coal Gasification Field Test. This test, part of WIDCO's Tono Project, was conducted at their Centralia, Washington, coal mine in the fall of 1983. It consisted of gas production from two consecutive cavities through both vertical and slant product wells. Samples from each of the two cavities were collected for chemical and physical characterization to provide data for the preliminary design of raw gas cleanup processes and as an aid in the identification of optimum end use for the product gas. The particulate mass loading, aerodynamic size distribution, and the composition and potential origin were determined. The raw gas condensate was characterized to provide data on aqueous phase gross organic and phenolic content and organic phase composition, boiling point distribution and density. These data are presented in the context of their impact on the selection of gas cleaning and wastewater treatment technologies for a full-scale gas production facility.

10751 (DOE/METC—85/5, pp 148-162) **Geotechnical studies on the overburden rock from the Hanna IV UCG site.** Marcouiller, B.A.; Burns, L.K.; Ethridge, F.G. (Colorado State Univ., Fort Collins). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Geotechnical and lithological characterization of the unaltered and altered overburden rock from the Hanna IV Underground Coal Gasification (UCG) site shows that the uniaxial compressive strength (q/sub u/) of the rocks has a positive linear correlation with percent calcite cement ($r^2 = .60$). An inverse, non-linear relationship exists between uniaxial compressive strength and porosity ($r^2 = .60$) and a positive non-linear relationship exists between uniaxial compressive strength and compressional wave velocities ($r^2 = .71$) Comparison of these data with previous work on overburden from the Rawlins, North Knobs UCG site shows that these relationships are essentially the same for both sites. Correlations using data from the North Knobs site are somewhat better than those for Hanna IV. Analyses of the overburden rock units directly overlying the cavity show that roof rock strength, lateral and vertical homogeneity, thickness of the overburden, well spacing and span of unsupported roof rock control the collapse of overburden into the reactor cavity. The Hanna II, Hanna IV and North

Knobs UCG sites, which experienced little overburden collapse, are characterized by roof rocks with abundant calcite cement, low porosity, high uniaxial compressive strength and an overburden thickness to maximum span of unsupported roof rock ratio greater than one. The Hoe Creek III site, which experienced overburden collapse to the ground surface, is characterized by a laterally discontinuous roof rock unit with high porosity, little calcite cement and an overburden thickness to maximum span of unsupported roof rock ratio of less than one.

10752 (DOE/METC—85/5, pp 178-187) **Use of laboratory combustion tube data in monitoring and designing UCG field tests.** Bell, G.J.; Gunn, R.D. (Univ. of Wyoming, Laramie). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—). Contract AS20-77LC01761;AS20-82LC10887.

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Successive field tests of UCG conducted at a single site have shown a serious lack of reproducibility which presents serious problems for the design of any plant built to utilize the gas produced. Cost precludes the use of many pilot tests to more carefully define the plant design basis. It is shown in this paper how relatively inexpensive laboratory tests along with the use of mathematical models and data from at least one two well pilot test can be used to provide a better design basis for scale up to commercial production.

10753 (DOE/METC—85/5, pp 188-201) **Self-ignition and reverse combustion setting of operating conditions for the Haute Deule site test.** Pavone, D.; Gadelle, C. (Institut Francais du Petrole, Rueil-Malmaison). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Before the beginning of the reverse combustion and gasification operations at la Haute Deule, experimental trials in the laboratory and models have been used to set up the operating conditions where the risks of self-ignition appear to be limited with no disadvantages to the reverse combustion process. These results indicated the composition of the injected gas (O_2, CO_2, N_2) which seems appropriate. A first test of injection of gas mixtures on the Haute-Deule site was carried out in December 1983; the results were fully consistent with the predicted outcome, thus confirming that the studies were valid. A simplified model allows then to explain the various phenomenons which have been observed.

10754 (DOE/METC—85/5, pp 215-226) **Heat exchange effects during underground gasification of thin coal layers.** Ronde, H.; Bruining, J.; Essink, J.P.O.; Maljaars, A.P.E. (Univ. of Technology, Delft, Netherlands). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Heat exchanges affect the gasification process particularly of thin coal layers. Further experimental evidence is presented that heat lost to the surroundings is partly reintroduced into the reaction zone (heat recuperation). This heat recuperation effect has now been quantified by the finite element calculation of the transient temperature distribution. The calculated values show good agreement with the experimental data. The calculation shows, moreover, that the temperature rise in the coal bed above the adiabatic level must be partly attributed to the heat recuperation effect. Therefore heat recuperation has a significant effect on the gasification reactions.

10755 (DOE/METC—85/5, pp 242-260) **Economic evaluation of methanol and SNG production using UCG.** Barone, S.P.; Gash, B.W.; Siegel, M.M. (Gas Research Institute, Chicago, IL). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The economics of extraction of raw, medium-Btu gas from a deep, thick, Western subbituminous coal using underground coal gasification technology and conversion of the produced gases into SNG and methanol using conventional technology were investigated. The overall study included a Base Case followed by several sensitivity cases including: (1) coproduction of SNG and methanol; (2) reduced plant output; (3) alternate raw gas composition; and (4) increased coal seam depth. The Base Case produced approximately 255MM scfd of SNG at $4.72/MMBtu (4th quarter 1982 Levelized Constant Dollar (LCD) Price). Coproduction of methanol and SNG resulted in an SNG price ranging from $4.41 to $1.50/MMBtu when the selling price of methanol was varied from $0.38 to $0.51 per gallon. Reducing the plant capacity to one-sixth Base Case increased the LCD price to $8.36/MMBtu. Increasing the methane content of the raw gas from 5.6 to 11.7% (dry basis) reduced the LCD price to $3.68/MMBtu. Increasing the coal seam depth to 1400 feet and using the raw gas composition with 11.7% methane resulted in an LCD price approximately equal to the 11.7% methane case with a coal seam depth of 700 feet.

10756 (DOE/METC—85/5, pp 271-282) **Underground coal gasification commercialization concepts.** McKinsey, R.R.; Gould, G.D. (Bechtel Group, Inc., San Francisco, CA). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Field testing has shown that air injection can produce a low Btu gas whose quality is suitable for feeding to a combined cycle turbine generator system for electric power generation. A conceptual economic comparison of Gulf's Underground Coal Gasification (UCG) technology developed for steeply dipping coal beds (SDB) with other coal-based power generation systems, including surface IGCC facilities, is provided. An integrated systems approach is described.

10757 (DOE/METC—85/5, pp 283-290) **GRI perspective on UCG as an SNG supply option.** Hill, V.L.; Barone, S.P. (Gas Research Institute, Chicago, IL). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Support of underground coal gasification (UCG) by the Gas Research Institute (GRI) has been ongoing since 1979. This effort has involved both base technology development in cooperation with the Department of Energy (DOE) and assessment of end-product costs in conjunction with industry. In-situ gasification as a future substitute natural gas (SNG) supply option will be dependent on its competitiveness with all alternate sources based on one inherent advantage - low feedstock cost. Future UCG field tests should, therefore, be designed to provide engineering data that permit realistic estimates of end-product costs. Factors affecting these costs - oxygen utilization, coal recovery, well spacing and environmental control - should be assessed in these tests. Finally, involvement by industry that will eventually commercialize any developed technologies is an essential ingredient of any field test program.

10758 (DOE/METC—85/5, pp 291-297) **UCG - derived synthesis gas: an economic comparison.** Moll, A.J. (SFA Pacific, Inc., Mountain View, CA). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Carbon monoxide-hydrogen synthesis gas (syngas) is emerging as an important intermediate for the production of a variety of chemicals and fuels. In this paper the prospects for expanding syngas production is examined. The production of syngas via underground gasification is compared with syngas production from conventional feedstocks and via surface coal gasification. It is found that cheap natural gas even in remote regions such as Saudi Arabia and the USSR is clearly today's most economical syngas feedstock. However, coal and coke will become competitive among domestic feedstocks as the present gas surplus disappears and decontrolled gas prices increase. UCG, when demonstrated commercially, may be an economically attractive alternative method of producing syngas. A range of production alternatives are presented. In addition, the future prospects of syngas products is assessed.

10759 (DOE/METC—85/5, pp 299-306) **Experimental study of coal ash catalyzed reactions between carbon monoxide and hydrogen.** Penner, H.A.; Haynes, H.W. Jr. (Univ. of Wyoming, Laramie). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The ash from a sample of Rawlins, seam G, coal was subjected to tests of catalytic activity in the presence of hydrogen and carbon monoxide (H_2/CO - 3/1) at two pressures (125 psig and 225 psig) and temperatures in the range 500 to 700°C. The carbon monoxide reacts to form methane, carbon and carbon dioxide in yields of roughly 40%, 40% and 20%, respectively. When compared on a unit char basis the methanation reaction proceeds at roughly the same rate as char gasification by carbon dioxide. More work is needed to identify the catalytic component of the ash.

10760 (DOE/METC—85/5, pp 307-315) **Simulation of UCG in great depth.** Guntermann, K.; Choi, J.O.; Beyer, L.G.; Klingenberger, P.; Franke, F.H. (Technische Hochschule Aachen, West Germany). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Underground coal gasification (UCG) is perhaps the most feasible method for recovering coal energy of deep-lying seams, which cannot be mined economically by known conventional methods. In order to develop a technology for this gasification process, intensive laboratory and theoretical work is needed to clear up the phenomena and deliver data for a successful field experiment. At great depth, a UCG-process requires very high pressure and causes self ignition problems. A method for investigating self-ignition, using DTA-methods, has been developed and shows first results. UCG in great depth needs a wide well spacing, because the drilling costs are a great part of the capital investment requirements. In consequence a channel gasification process has to be optimized. An apparatus to find steering mechanisms on channel gasification is in construction. To provide a large reacting surface area, necessary for efficient reaction, a pressure oscillation procedure is used, and has shown promising results and shall be optimized.

10761 (DOE/METC—85/5, pp 325-332) **Influence of H_2O at high PT-conditions upon the volumetric and mobility behavior of bituminous coal for in-situ-gasification after linking-process.** Palz, K.; Schloemer, H.J. (Universitaet des Saarlandes, Saarbruecken, West Germany). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

There are many proposals to produce a linking system between the injection and production wells at UCG studies. Up to now only channel burning may be successful. Gasifying bituminous coal in deep layered seams at higher pT-conditions the volumetric behavior of such coals receives particular notice. In all cases, in which fissures, cracks or ranges of enhanced permeabilities have been produced by m, directional drilling or electrolinking the channel or more precisely said the gas path diameters were not sufficient. The swelling character of bituminous coals represents a barrier for the permeability of the gasflux. To receive more information about the volumetric behavior of coals, which are expanding into a free space represented by channel linkings the effects of process variables like heating rate, flux rates of the process gas or the pressure and composition of the gas have been investigated.

10762 (DOE/METC—85/5, pp 349-356) **Results from a laboratory flow model for a UCG cavity.** Kennedy, K.M.; Riggs, J.B. (West Virginia Univ., Morgantown). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

A laboratory flow model was used to study the fluid flow behavior in a UCG cavity. The laboratory model was designed to be dynamically similar to a UCG system by equating the Reynolds number for the volumetric flow rate for the model. Water was used for the working fluid for the model and high energy density resistive heaters were used to heat the walls of the flow model to simulate a burning cavity wall. The model was used to study the flow behavior when the flow cell was empty and when partially filled with simulated rubble. For the void cavity studies, it was found that transport to the side walls was controlled solely by forced convection except at the lowest injection rate studied where mixed convection resulted. Dimensionless correlations were developed to relate the Nusselt number for heat transfer to the side wall to the Grashof and Reynolds numbers. The qualitative studies conducted with the cavity partially filled with rubble indicated significant alteration of the flow pattern as the result of the rubble. But a preliminary quantitative study of heat transfer to the side wall for a partially filled cavity indicated only a slight reduction. Using this work to estimate heat and mass transfer coefficients for UCG conditions predict that lateral growth by combustion and gasification is small compared with a growth mechanism based upon drying.

10763 (DOE/METC—85/5, pp 357-366) **Theoretical and experimental studies of reverse combustion.** Britten, J.A.; Krantz, W.B.; Visser, W.; Gunn, R.D. (Univ. of Colorado, Boulder). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—). Contract AS20-82LC10887.

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

This paper describes recent modeling and experimental studies of reverse combustion (RC) linking, aimed at understanding the propagation dynamics of a RC front. Modeling efforts have resulted in the development of simple, accurate analytical equations for the temperature and flame speed of a planar RC wave, by use of matched asymptotic expansions in an activation energy parameter describing the combustion kinetics. The effects of heat losses, anisotropic permeability and of different kinetic mechanisms have been analyzed. A linear stability analysis of this asymptotic model has been performed, and predictions of this analysis are applied to Hanna RC linking field test data. The ongoing experimental program involves performing RC experiments on two-dimensional samples of particle board and balsa wood. These experiments determine the shape, size and propagation rate of a RC channel under controlled upstream flow conditions. The progress of the burn front is monitored by infrared thermography. Results of preliminary experiments and discussion of the data obtained to date are described.

10764 (DOE/METC—85/5, pp 367-377) **Modeling and experimental studies of electrolinking.** Dautresme, B.; Krantz, W.B.; Fuller, J.F.; Gunn, R.D. (Univ. of Colorado, Boulder). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

This paper presents a new model describing the electrolinking process. A solution to the electrolinking propagation is developed by using the technique of matched asymptotic expansions in a parameter characterizing the sharp increase of the electrical resistivity of coal. A stability analysis of this propagation is presented. It shows that electrolinking, described as a type of displacement process, is always unstable. The model predictions are compared with limited literature data and are used to suggest an explanation for the unreliability of the process. The preliminary results of an experimental program designed to observe directly the electrolinks' appearance and to gain information on the process temperature as well as the underlying physics of electrolinking are also presented and discussed. The dielectric breakdown of the coal rather than pure resistance heating was found to be the driving force for electrolinking. The process temperature determined with an infrared thermal imager indicate that electrolinking is not a carbonization process.

10765 (DOE/METC—85/5, pp 378-387) **Biotreatment of UCG condensate and pattern water.** Humenick, M.J.; Shellenbarger, K. (Univ. of Wyoming, Laramie). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

This paper reports on the continued study of the treatment of UCG condensate by various processing schemes. The purpose of this work was to obtain design data for use in providing an optimal rather than a universal treatment scheme for UCG wastewater condensate. In the past, several treatment schemes have been studied and design data collected and published. This work presents new options for consideration and evaluation. The laboratory experimental project studied the following options: treatment of UCG condensate by (a) solvent extraction (Methyl isobutyl ketone, MIBK), ammonia stripping, and activated sludge; (b) solvent extraction by MIBK, ammonia stripping, and activated sludge with supplemental powdered activated carbon addition to the activated sludge unit; (c) ammonia stripping and dilution of the stripped UCG condensate with contaminated pattern water before treatment of the mixture with activated sludge; and (d) direct treatment of contaminated pattern water by activated sludge. Performance and kinetic information is provided for each option, along with a determination of relative toxicity of feeds and effluents for options (a) and (b).

10766 (DOE/METC—85/5, pp 400-406) **Models of the thermal state in an underground gasification well.** Gorez, R.; Passau, V. (Univ. of Louvain, Belgium). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Underground gasification experiments are conducted in Belgium: hot gas is produced by burning coal layers 1000 m beneath the ground level and collected through an exhaust well. In future experiments, the well could consist of two concentric pipes, than the gas would flow upwards through the inner pipe, and cooling water flowing downwards should be injected through the annular space between the two pipes in order to keep the wall temperatures between safety limits. Water should be vaporized and vapor should be superheated in the lower part of the well to avoid any risk of flooding the gas generator. In this proposed plant, the mixing of gas and superheated vapor in the bottom of the well yields a positive feedback on the thermal state of this part of the well. The whole thermal process is not self-regulatory and it must be controlled either by operators or by automatic controllers. Then, models of the thermal state in the well are needed in view of determining safe operating conditions and defining control strategies. A distributed parameter model has been set up and solved using finite-difference techniques. A static version of this model is used for computing temperatures, pressures and flows in steady-state operations, and a dynamic version of the model is used for determining transient responses to variations of gas temperatures or mass flow rate of gas or water.

10767 (DOE/METC—85/5, pp 407-423) **Analysis of early cavity growth in underground coal gasification.** Park, K.Y.; Mai, M.; Edgar, T.F. (Univ. of Texas, Austin). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

A laboratory-scale coal block gasification test has been performed on Texas lignite. The lignite coal exhibited a cavity elongated in the direction perpendicular to the bedding plane, which is similar to the behavior of Wyodak subbituminous coal. Experimental evidence indicates that the cavity elongation may have been caused by shrinkage of coal due to drying and pyrolysis. Large cracks were formed in the direction perpendicular to the bedding plane, while in the direction parallel to the bedding plane many fine cracks (bedding plane separations) were observed. Shrinkage of coal apparently plays a dominant role in crack growth perpendicular to the bedding plane. A one-dimensional unsteady state model has been developed to predict the movement of the cavity wall and drying front during the initial period of coal block gasification (i.e., laboratory-scale experiments).

10768 (DOE/METC—85/5, pp 424-443) **Oxidation kinetics and models for self ignition of coal in underground gasification.** Gadelle, C.; Pavone, D.; Chauvin, R.; Bruyet, B.; Philippe, J.L. (Institut Francais du Petrole, Rueil Malmaison). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

In order to achieve coal gasification, the linking channel that either existed naturally or was artificially induced between two wells must be enlarged using reverse combustion. In deep coal seams, the chances of success of reverse combustion and consequently also of gasification are somewhat reduced because of the risks of self-ignition of the coal. Numerical models for self-ignition of coal have been developed to simulate the phenomenon in porous or fractured medium. The models request the determination of the kinetic data on coal oxidation at low temperature; various methods have been used for this purpose. These results indicate the influence of the main parameters (seam temperature, flow rate and composition of injected gas, injection pressure) on the time delay preceding self-ignition and also revealed the position where self-ignition occurs.

10769 (DOE/METC—85/5, pp 460-476) **Sweep efficiency model for underground coal gasification.** Chang, H.L.; Himmelblau, D.M.; Edgar, T.F. (Univ. of Texas, Austin). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

A new sweep efficiency code for underground coal gasification (UCG) has been developed. The simulation model is based on flow through rubble in the cavity as well as through the open channel and uses a tanks-in-series model for the flow characteristics. The model can predict cavity growth and product gas composition subject to several types of water influx, roof collapse, and spalling. The self-gasification of coal is taken into account in the model, and the coal consumption rate and the location of the flame front are determined by material and energy balances at the char surface. The model has been applied to the Hoe Creek III field tests (for the air gasification period). Predictions made by the model such as cavity shape, product gas composition, temperature profile, and overall reaction stoichiometry between the injected oxygen and the coal show reasonable agreement with the field test results.

10770 (DOE/METC—85/5, pp 477-487) **Use of post-burn coring data from the Hanna III field test to infer the spalling characteristics, water influx and heat losses.** Tantekin, S.B.; Krantz, W.B.; Gunn, R.D. (Univ. of Colorado, Boulder). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Photographs of the cores extracted from the rubble pile during the post-burn coring of the Hanna III UCG field test are used to obtain estimates of the spalling-rate parameters for the three overburden strata affected during this UCG burn. These estimates of the spalling-rate parameters are used in the Spalling-Enhanced-Drying Model developed by Krantz and co-workers to advance new predictions for the postburn cavity shape and daily water influx which are shown to agree well with measured values for this field test.

10771 (DOE/METC—85/5, pp 488-499) **Parametric study of a simplified model of coal face spalling.** Mortazavi, H.R.; Emery, A.F.; Corlett, R.C.; Lockwood, W.R. (Univ. of Washington, Seattle). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—). Contract AS20-82LC10884.

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The spalling of sidewalls or roofs in underground coal gasification is modelled by assuming that it occurs due to strength reductions caused by heating, drying, or crack formation. The temporal or spatial variations of these effects are determined by the properties which control internal convection, diffusion, and conduction in

the coal, liquid, vapor, or gas flows. This paper examines the effects of changing these properties to determine the sensitivity of the regression process. It is found that the drying process is primarily sensitive to the coal thermal conductivity, internal diffusion of vapor and the surface heat transfer coefficient while the regression is dominated by the surface heat transfer coefficient and only slightly affected by the surface resistance to vapor flow.

10772 (DOE/METC—85/5, pp 500-511) **Subsidence modeling of Rawlins underground coal gasification Tests 1 and 2.** Avasthi, J.M.; Lee, J.K. (Gulf Research and Development Co., Pittsburgh, PA). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Gulf Research and Development Company conducted Rawlins Tests 1 and 2 under the DOE sponsored UCG/SDB program. In both tests, no surface subsidence has been observed to date. The disturbance of the immediate roof strata in the vicinity of the UCG reactor was expected as a result of the cavity growth. A finite element modelling program developed by the Ohio State University and funded by GR & DC was used to determine the subsidence and failure zones in the immediate roof above the affected area in the gasified coal seam. The results of this model study are compared with the post burn studies of the two tests.

10773 (DOE/METC—85/5, pp 512-521) **Overview of hygrothermomechanical response modeling associated with underground coal conversion.** Advani, S.H.; Lee, J.K.; Chen, S.M.; Chen, K.S.; Aboustit, B.L. (Ohio State Univ., Columbus). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—). Contract AS20-82LC10886.

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Basic governing equations and numerical applications associated with hygrothermomechanical response modeling of underground coal gasification (UCC) processes are presented. The reported research includes finite element evaluation of thermoelastic and thermoplastic consolidation model response evaluation, i.e. the effects of temperature, moisture, and stress. Numerical results for selected models are presented and discussed. Model extensions pertinent to the inclusion of the drying zone are also examined. In addition to the aforementioned UCC code development, results from models with specialized options are discussed. These include (i) the moving boundary finite element investigations for cavity configuration and subsidence prediction and (ii) two dimensional versus three dimensional thermoelastic response comparison. The applicability of these models in the context of their UCC field application is revealed.

10774 (DOE/METC—85/5, pp 522-530) **Modeling of 2-D cavity growth using continuously deforming finite elements.** MacKinnon, R.J.; Sepehrnoori, K.; Thompson, T.W. (Univ. of Texas, Austin). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

This paper presents a simplified finite element cavity growth model that is based on Biot's consolidation theory and incorporates a continuously deforming numerical grid. By allowing the numerical grid to move with the cavity boundary, it is possible to maintain a sufficiently dense grid in the region where pore pressure, stress, and temperature gradients are large, and a less dense grid in the regions of low activity. A brief description of the numerical method and its application are given. Some preliminary results illustrating the influence of cavity growth rate and cavity pressure on cavity stability are also examined.

10775 (DOE/METC—85/5, pp 555-575) **What can be learned from linking tests at great depth?.** Ledent, P. (Institution pour le Development de la Gazeification Souterraine, Liege, Belgium). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Since 1976 the governments of the Kingdom of Belgium and of the Federal Republic of Germany have undertaken a common research program aiming at the development of U.C.G. at great depth. During the first in situ experiment, which is carried out in Belgium, on the site of Thulin, at 860 m depth, unforeseen difficulties arose when trying to make a linking channel by reverse combustion. A lot of experimental results were gathered during several test periods spread over 1981-1984. On the basis of these results a theory can be formulated, showing the preponderant influence of high pressures prevailing at great depth and the fact that coal, which has to bear pressures beyond its crushing strength, ceases to behave like a rigid material. The permeability of the deposit becomes a function of the equilibrium between the gaseous pressures and the lithostatic pressure and tenths of tons of coal can be consumed by combustion inside clefts, without increasing their opening and without creating a channel. This analysis does not question the interest of developing U.C.G. at great depth, but it leads to formulate a number of suggestions concerning the methods which should be applied for the preparation of underground gas-generators.

10776 (DOE/METC—85/5, pp 576-590) **Excavation evaluation of the controlled burnout of an abandoned coal mine.** Soroka, K.E.; Chaiken, R.F.; Dalverny, L.E.; Divers, E.F. (Dept. of the Interior, Pittsburgh, PA). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The Bureau of Mines Calamity Hollow Mine Fire Project demonstrated the new technological approach, Burnout Control, which utilizes controlled in situ combustion to control fires in abandoned coal mines and waste banks. This approach supports lowered costs of reducing the environmental and public safety hazards associated with waste coal fires and could enable the conversion of a coal waste into a coal resource. Following a 4-month continuous operation of Burnout Control at the site of a shallow abandoned coal mine fire, a novel water injection - fume exhaustion technique was utilized to rapidly cool the underground heated zones, before the entire 1-1/2 acre fire site was excavated and backfilled. The observations made during excavation and their interpretation relative to fire propagation and quench efficiency are described. The excavation provided good definition of the pillar/entry layout of the mine, burn areas along the entries and roof and coking in various parts of the pillars. Visual estimates of burned areas supported the calculated estimates that approximately 20,000 tons of strata were heated to a height of about 10 ft above the seam. The excavation analysis supports the feasibility and effectiveness of Burnout Control for abandoned coal mine fires, and the efficiency of the water injection - fume exhaustion technique for rapidly quenching the burning and heated zones of such fires.

10777 (DOE/METC—85/5, pp 591-597) **Next phase of WIDCO's Tono project.** Paul, R.A. (Washington Irrigation & Development Co., Centralia). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The Tono Project, WIDCO's Underground Coal Gasification (UCG) Technology Development Program, has progressed through laboratory, field laboratory, and the first field tests. The results to date have shown that WIDCO's coal is a prime candidate for UCG development and that the environmental, political, and economic climate in Washington are supportive of continued UCG development. The positive results achieved by The Tono Project to date have encouraged WIDCO to continue with this program. However, the focus for future development will change from research to commercialization and from single module to multi-module technology. The objectives, plan, schedule, and cost estimate have been completed for the next phase of The Tono Project. This phase will be a long-term, multi-module field tests. The overall objective will be to provide the input for an economic evaluation of whatever commercial scenario WIDCO chooses to pursue. This field test is envisioned as the last step prior to a pilot scale commercial development.

10778 **(DOE/METC—86/6030) Surface gasification data system: feasibility studies overview report.** (USDOE Morgantown Energy Technology Center, WV). Nov 1985. 209p. NTIS, PC A10/MF A01; GPO Dep. File Number DE86001021.

The purpose of this report is to evaluate the final reports prepared for 19 proposed coal gasification plants funded under the Alternative Fuels legislation. These 19 studies represented the best set of publicly available information on commercial-scale coal gasification plants. They encompassed all areas that would be relevant in determining if any of the plants should be constructed: general information business considerations, process information, cost data, and environmental considerations. The performers of the studies were awarded US Department of Energy (DOE) contracts in 1980. Study results, in the form of final reports for the feasibility studies, were returned to the Morgantown Energy Technology Center (METC), the DOE center with lead responsibility for gasification research. Data from the studies were abstracted and entered into the Major Plants Data Base (MPDB), a system developed and used at METC to aid in the analysis of design and operating data from commercial- and demonstration-scale synfuels plants. The MPDB is designed to store and retrieve data in five broad categories: general project information, process and technical information, financial and business data, capital cost information, and EHSS (environmental health, safety, and socioeconomic) data. The MPDB system was used to retrieve data and aid data analysis for this report. The evaluation of the reports was twofold. First, each study was analyzed individually to determine whether the data expected to be in the report were indeed present, and whether they were of the quality expected. Secondly, studies were compared with one another to see what conclusions could be drawn from these data. The individual evaluation of the various studies showed that, in general, the data provided were of high quality. 24 refs., 13 figs., 46 tabs.

10779 **(DOE/OR/21400—T216) VPI-3 alkali attack of coal gasifier refractory linings. Progress report No. 4, October 1-December 31, 1985.** Sun, T.; Brown, J.J.; Farkas, D. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Materials Engineering). 15 Jan 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005147.

More than 300 data points were calculated for the thermochemical diagram shown in Figure 1. Solid sodium carbonate is the stable alkali phase below 1130°K. Below this temperature, alkali corrosion would not appear to be a significant problem because the reaction would be solid-state and sluggish. However, carbon deposition may be a problem since high pressure favors the formation of CO_2, and carbon is deposited. Above 1130°K, sodium carbonate melts at all pressures, increasing the corrosion potential of the alkali. Above 1270°K, sodium vapor begins to form at low pressure by the reaction given. Above 1340°K, in addition to sodium vapor, sodium hydroxide vapor is generated. At this temperature alkali reaction will become a serious problem. Once alkali vapor is generated, it will circulate and form deposits at the cool zones in the reactor where alkali attack previously was considered less significant. However, the corrosion process may be retarded if the pressure is increased because some or all of the alkali vapor could condense to liquid as shown in the high pressure region where alkali attack is considered less damaging. But in the high temperature regions where alkali vapor exists at all pressures, alkali corrosion will likely be serious. The generation and transport of alkali vapors may be responsible for corrosion in coal gasifiers under some conditions. Therefore, it is recommended that pressures rather than temperatures be increased in the gasifier when alkali resistance of refractory linings is important. 2 refs., 1 fig.

10780 **(DOE/PC/60046—7) Enhanced coal liquefaction with ammonia and amines in single and binary solvent systems. Seventh quarterly report, April 1-June 30, 1985.** Chen, W.Y. (Gulf South Research Inst., New Orleans, LA (USA)). 1985. Contract AC22-83PC60046. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86003932.

To provide a better understanding of the role and fate of primary aliphatic amines as solvent in coal liquefaction, the following potentially important variables were examined: carbon chain length of amine; addition of hydrogen and tetralin to the solvent; and difference among the primary, secondary and tertiary amines. Several major conclusions can be drawn from this study: (1) primary aliphatic amines within a specific range of carbon numbers offer optimal dissolution power, and this range of selection is temperature-dependent. For example, optimum dissolution by amines having four to ten carbons is achieved at 230°C; (2) hydrogen enhances the liquefaction rate at 230°C. This observation leads to the conclusion that ester cleavage due to nucleophilic attack by amine is not the rate controlling reaction at this temperature although there has been wide speculation concerning this mechanism. Hydrogen is not expected to enhance nucleophilic reactions; (3) tetralin also enhances the rate of conversion, which further suggests that a free radical reaction is involved in the early stage of coal liquefaction; (4) for aliphatic amines with six carbons, primary amine (n-hexylamine) shows a much higher liquefaction efficiency (94%) than dipropylamine (20%) and triethylamine (33%). This could imply that reductive amination of carbonyl in the coal to amine by primary amine could also be an important reaction during liquefaction. 8 refs., 2 figs.

10781 **(DOE/PC/60798—9) Catalytic hydrotreatment studies with model compounds. Quarterly report, October 1, 1985-December 31, 1985.** Satterfield, C.N.; LaVopa, V. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering). 1985. Contract FG22-83PC60798. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004550.

In Quarterly Report No. 7 we presented preliminary studies of the hydrodeoxygenation (HDO) of dibenzofuran which indicated, surprisingly, that as much as 75% of the products are C_6-C_7 single ring compounds. We have now checked the identification of these compounds by GC/MS analysis. We also find that the oxide form of the catalyst behaves quite differently from the sulfide form, both in activity and selectivity. 10 figs., 2 tabs.

10782 **(DOE/PC/60813—9) Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985.** Seapan, M.; Crynes, B.L. (Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering). Nov 1985. Contract FG22-83PC60813. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86003827.

Hydrogenation of Tetralin in the presence and absence of carbon disulfide was studied. Our presulfidation procedure was modified to achieve more severe sulfidation. In hydrogenation of hydrocarbons, in-situ generation of hydrogen sulfide is required to maintain the catalyst at its sulfided state. Otherwise, a catalyst will lose its activity due to the consumption of the sulfided state which may be mistaken for coking deactivation. Nine model compound runs using decalin, methyl-isobutyl ketone, quinoline, and titanocene dichloride were conducted on a NiMo/alumina and a CoMo/alumina catalyst. One hydrotreatment run using SRC-II distillate was conducted in a trickle bed with periodic doctoring with titanocene dichloride. 6 refs., 7 figs., 10 tabs.

10783 **(DOE/PC/70018—13) Coal liquefaction process solvent characterization and evaluation. Topical progress report, July 1, 1985-September 30, 1985.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. (Conoco, Inc., Library, PA (USA). Coal Research Div.). Nov 1985. Contract AC22-84PC70018. 120p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86005271.

This report includes results and interpretation of Conoco's analyses of sixty process-oil samples from Wilsonville Run 248 operated from February through May, 1985, in the DITSL and ITSL modes with Illinois 6 bituminous coal. Analytical results and their interpretation are presented for a set of thirty-one process oils from HRI CTSL Run 227-26 with Clovis Point subbituminous coal. Results are reported for a set of microautoclave tests performed to investigate the effect of solvent quality on liquefaction yields and product characteristics. 10 refs., 12 figs., 37 tabs.

10784 **(DOE/PC/70768—3) Kinetics of coal pyrolysis and devolatilization. Technical progress report, August 1, 1985-October 31, 1985.** Seery, D.J.; Freihaut, J.D.; Proscia, W.M. (United Technologies Research Center, East Hartford, CT (USA)). 1985. Contract AC22-84PC70768. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86003871.

The objective of these coordinated experimental and modeling studies is to develop an improved understanding of the kinetics of coal devolatilization which are relevant to suspension firing of powdered coal. A HPLC-GPC technique has been developed having the sensitivity necessary to distinguish relative changes in molecular weight distributions of small samples of tars produced in research reactors. The effect of transient heating conditions on relative molecular weight distributions of tars has been demonstrated using the technique. Absolute calibration awaits cross calibration of size cuts of selected species by use of mass spectrometric techniques. Elemental compositions of a complete range of size cuts of a HVA Bituminous coal (PSOC 1451) have been determined. The analysis indicates significant mineral segregation as small, apparently independent, particulates in the aerodynamic cuts of this coal. Replicate analysis indicates a "homogenous" blend of the organic and inorganic subsieve size particulates in these cuts. Elemental analyses indicate some organic matter segregation with particle size characteristics. Infrared absorption analyses of the cuts verify the mineral matter segregation with size cuts but show no significant change in organic functional groups with particle size. A modified heated grid apparatus has been completed and teated. The microcomputer controlled heating curves allow maximum flexibility in temperature trajectories to a given final temperature. The new apparatus will allow more precise determination of the kinetics of intraparticle tar formation, secondary reactions and evolution than previously obtainable. 14 figs., 3 tabs.

10785 **(DOE/PC/70812—5) Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985.** Haynes, H.W. Jr.; Baker, J.R.; McCormick, R.L. (Wyoming Univ., Laramie (USA). Dept. of Chemical Engineering). 30 Dec 1985. Contract FG22-84PC70812. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004551.

Three bench scale hydrotreating runs were completed during the last quarter using a distillate fraction of a coal pyrolysis oil as the feedstock. The first of these, Run BMC05, was a process variable study which was terminated after nearly 400 hours of continuous operation. A kinetics model for specific gravity reduction was developed from these data. The decelopment of kinetics models for hydrogen uptake and heteroatom removal must await completion of the analytical workup of the liquid products. Two deactivation runs were undertaken to explore the effects of sodium impregnation on catalyst deactivation rate. Analytical workup of the products is not yet complete. A number od exploratory catalyst preparations were characterized by temperature programmed desorption (TPD) of an organic base. The acidity of a WO_3/alumina catalyst was similar to MoO_3/alumina. The acidity of sulfided molybdate on a carbon support was almost nil. This is surprising the view of our results with alumina based catalysts and the fact that unsupported MoS_2 prepared by thermal decomposition of ammonium thiomolybdate is acidic. Hydrotreating catalysts containing various additives - magnesium, phosphorous, cobalt and nickel have also been characterized. 14 refs., 7 figs., 4 tabs.

10786 **(DOE/PC/70814—5) Direct coal liquefaction using iron-titanium hydride as a hydrogen distribution and catalytic material. Progress report No. 5, September 1-November 30, 1985.** Smith, J.E. Jr. (Alabama Univ., Huntsville (USA)). 20 Dec 1985. Contract FG22-84PC70814. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004387.

During this reporting period two direct coal liquefaction experiments have been completed and a third is underway. These experiments have produced conversion and selectivity data on samples of Alabama bituminous coal slurried in tetralin and catalyzed using iron-titanium hydride. The experiments address the liquefaction of an agglomerating coal. Conversions of 45 to 55% DAF in 30 min have been recorded at 500°F and 520 psia. Equipment modifications were made in an attempt to eliminate the problem of alloy binding in the hydride formation vessel. 4 figs., 4 tabs.

10787 **(DOE/PC/80913—1) Biodegradation and bioconversion of coals by fungi. Quarterly progress report No. 1, October 1-December 31, 1985.** Ward, B. (Mississippi Univ., University (USA). Dept. of Biology). 1985. Contract FG22-85PC80913. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005168.

Following a month-long start-up period during which the principal investigator traveled to several sites of lignite outcrops to collect samples, efforts were begun to isolate new strains of coal-bioconverting fungal strains. Out of about thirty different organisms isolated from weathered samples of three different types of lignite, three isolates exhibited biosolubilization of the one lignite tested to date. These organisms have not yet been identified but they appear to be new strains of lignite-degrading fungi. We have observed that degree of biosolubilization varies among apparently similar samples of the same lignite. Weathered lignite is more readily solubilized than is previously unexposed lignite, but even tests on weathered coal have not been consistently repeatable. We have begun experiments designed to identify one or more factors of weathering which render coal more readily attacked by fungi. We hope to establish methods whereby consistently repeatable assays can be performed on bioconversion of coals. 2 refs., 1 fig., 1 tab.

10788 **(DOE/PC/81003—T1) Alternative method for the removal of oxides of nitrogen and sulfur from combustion processes. First quarterly technical status report, September 17-December 31, 1985.** Joshi, A.V. (Ceramatec, Inc., Salt Lake City, UT (USA)). 1985. Contract AC22-85PC81003. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005129.

The long range multi-phase objective is to develop an effective, reliable low cost electrochemical system for removal of SO/sub x/ and NO/sub x/ from utility-scale combustion processes. An initial nine month Phase I has been initiated to determine the feasibility of the electrochemical approach. Specific objectives of this first phase include the following: demonstrate that NO/sub x/ and SO/sub x/ can be electrochemically decomposed to yield nitrogen gas and elemental sulfur; experimentally evaluate the key parameters and gather a data base that can be used for system design; explore design options for application to utility scale plants; explore fabrication alternatives for the doped zirconia; and identify the key problems that must be considered in Phase II.

10789 **(EPRI-AP—4378) Two-stage liquefaction catalyst evaluation. Final report.** Barclay, R. Jr.; Johnson, R.A.; McLean, J.B. (Hydrocarbon Research, Inc., Lawrenceville, NJ (USA)). Jan 1986. 56p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920121.

The objective of this program was to evaluate selected catalysts in comparison with Shell 324M catalyst for effectiveness in the hydrotreater at EPRI's Wilsonville coal liquefaction pilot plant. HRI's standard CASTAL test, used to evaluate catalysts for ebullated-bed hydroprocessing of residual petroleum oils, was modified for use with a feedstock made by blending first-stage heavy distillate and deashed first-stage residuum samples obtained from Wilsonville. The modified test was used to compare Shell 324M, which has a unimodal pore size distribution, with Amocat 1C and Shell S-317. The latter two catalysts have bimodal pore size distributions with substantial macropore (diameter >500A) volume. The catalysts differed substantially in their effectiveness for removal of titanium and calcium, in the order Shell S-317 > Amocat 1C > Shell 324M. These differences in demetallization activity could be correlated with the pore size distribution. Run products were also tested for nitrogen contents of the 650 to 850°F distillate fraction and for conversion of Ramsbottom Carbon Residue (RCR) and pentane- and toluene-insoluble materials in the 850°F$^+$ residua. Selected whole product samples were tested for donor solvent quality in microautoclave tests with Illinois No. 6 coal. The differences among the catalysts with respect to all of these functions were small compared to the differences in demetallization activity. Overall, differences in performance among the three catalysts were too small to

indicate clear superiority of one catalyst over the others. 11 figs., 11 tabs.

10790 **(ORNL/SGMP—85/2) Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1985.** (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 89p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86005338.

The objective of the Surface Gasification Materials Program is to conduct research and development on materials for application to the specific needs of coal gasification systems. One of the goals of the program is to evaluate innovative fabrication methods which have the potential to lower costs and improve reliability and safety for gasifier vessels and components. Another goal is to conduct engineering-scale development and application of materials for coal gasification systems to ensure that the materials of construction for pilot plants and furture large-scale plants can be properly selected and specified. Contents of this report include: (1) corrosion studies of plant materials surveillance tests; (2) slagging gasifier refractories - application/evaluation; (3) protective coatings and claddings - application/evaluation; (4) corrosion of structural ceramics in coal gasification environments; (5) advanced pressure vessel materials technology; (6) electroslag component casting; (7) production and evaluation of electroslag casting; and (8) materials review and component failure analysis in support of coal gasification processes and plants.

10791 **(ORNL/TM—9815) Thermal conductivities of Wilsonville solvent and Wilsonville solvent/Illinois No. 6 coal slurry.** Mrochek, J.E.; Wilson, J.H.; Johnson, J.K. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 55p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86005262.

This report describes instrumentation and techniques that, when used in conjunction with a unique bench-scale flow system for coal liquids, enabled thermal conductivity measurements of fresh, slurried coal-solvent mixtures under more or less dynamic flow conditions. The transient hot-wire technique was selected as the method of choice, and a high-temperature, high-pressure cell, rated for temperatures to 850 K and pressures to 30 MPa (4366 psig), was fabricated from type 347 stainless steel. The cell, constructed of two identical manifolds joined by a length of pipe (34.9-mm OD x 19.7-mm ID), contained a platinum hot wire gauge (40 SWG, 0.076-mm diam) ~29 cm in length. The measurement system consisted of a commercially available, precision dc current source (programmable and capable of current output to 164 mA) and a custom-built, switching/voltage amplification network with a digital oscilloscope for data acquisition. Measurements of the voltage drop across the hot-wire gauge (4096 data points) were transferred to a minicomputer for analysis and long-term storage. Thermal conductivities were measured on a Wilsonville solvent and a slurry prepared from this solvent and Illinois No. 6 coal over a temperature range of 295 to 505 K. Thermal conductivities for both the solvent and the slurry decreased with increasing temperatures, similar to the trend showed by toluene. The solvent decreased from 1.23 to 1.02 mW cm^{-1} K^{-1} over the temperature range 296 to 438 K, while the slurry decreased from 1.51 to 1.02 mW cm^{-1} K^{-1} over the range 295 to 505 K. 20 refs., 9 figs., 7 tabs.

10792 **(PNL-SA—12628) Determination of radical initiating and hydrogen donating properties of coal liquefaction process solvents by reaction with fluorenone.** Camaioni, D.M.; Later, D.W. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 6p. (CONF-851003—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004878.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

The reduction of fluorenone to fluorene by some coal liquefaction process solvents at 400°C has been studied. Marked differences in the degree of conversion to fluorene were observed. The differences are attributed to the relative abilities of the solvents to initiate the reduction reaction and transfer hydrogen to radicals. 14 refs., 1 tab.

10793 **(PNL-SA—13157) Coal conversion (liquefaction/gasification): engineering considerations and relationships among physical, chemical and toxicological properties of resulting materials.** Gray, R.H.; Drucker, H.; Massey, M.J.; Craun, J.C.; Fillo, J.P.; Reilly, C.A.; Renne, R.A.; Wilson, B.W. (Pacific Northwest Labs., Richland, WA (USA); Argonne National Lab., IL (USA); Environmental Research and Technology, Inc., Concord, MA (USA); Reilly Tar and Chemical Corp., Indianapolis, IN (USA)). Dec 1985. Contract AC06-76RL01830. 11p. (CONF-851201—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004875.

From 7. Miami international conference on alternative energy sources; Miami Beach, FL, USA (9 Dec 1985).

Over the last decade, a substantial data base has been developed concerning the physical, chemical and toxicological properties of coal conversion (liquefaction and gasification) materials. This work has evaluated products and byproducts obtained from processes that, in many cases, were operated under a variety of conditions and configurations. We have recently completed a major effort to compile, integrate and evaluate the chemical, physical, toxicological, and engineering database that has been developed. The effort has involved several laboratories, organizations, and individuals. This paper summarizes the results of this effort soon to be published in book form, and indicates those properties/characteristics (i.e., boiling point and degree of aromaticity) of coal conversion materials that most directly relate to toxicological effects. Toxicological endpoints discussed emphasize mutagenic and carcinogenic responses. 25 refs., 4 figs.

0106 Properties

REFER ALSO TO CITATION(S) 10743, 10784, 10791, 10821, 10822, 10825, 10826, 10827, 10832, 10839, 10854, 10855, 10856, 10897, 10904, 10928, 11674

10794 (CONF-850530—, pp 568-578) **Characterization and combustion of low-rank coal-water slurries.** Germane, G.J.; Smoot, L.D.; Eatough, C.N.; Jones, R.G.; Rawlins, D.C. (Brigham Young Univ., Provo, UT). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The Combustion Laboratory at Brigham Young University is presently conducting a low rank coal-water slurry characterization and combustion research program for the Morgantown Energy Technology Center of the US Department of Energy. This paper describes the coal-water mixture (CWM) test plan and initial result for physical property characterization of several subbituminous and lignite slurries, and slurry spray and combustion studies with lignite CWM. The combustion tests are being conducted in the laboratory cylindrical slurry combustor for comparison with results from a predictive computer model. The CWM test plan includes characterization and comparison of promixate and ultimate analyses for subbituminous and lignite slurries, produced at three different steam drying temperatures, and their virgin coals. Moisture content, stability and rheology of the low rank coal slurries are reported and compared to similar results for bituminous coal slurries obtained in an earlier program at this laboratory. Studies of lignite slurry spray dispersion and distribution, and droplet-particle velocity and size have also begun. Low rank slurry combustion characterization studies are planned to determine methods of efficient combustion, to identify the effects of key operating variables on coal burnout and pollutant formation, and to obtain detailed space-resolved measurements of carbon conversion, nitric oxide and sulfur pollutants and particle concentration. 11 references, 7 figures, 4 tables.

10795 (CONF-850530—, pp 840-854) **Hydraulics data and materials performance from phase I testing of coal water mixtures.** Motley, E.P.; Meyers, R.A.; Shih, C.C.; Jones, J.F.; Lim, W.Y. (TRW Energy Division, Redondo Beach, CA). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The feasibility of using Coal Water Mixtures (CWMs) as a prime alternative fuel is being considered for a variety of combus-

tion applications. TRW, under sponsorship of the Department of Energy, is supporting CWM technology development by implementing a program involving the evaluation of front end boiler equipment and components for CWM service as well as the analysis of CWM fluid behavior. The project objective is to generate a data base for the selection of plant equipment for the design of new CWM installations or for retrofits of existing fuel oil furnaces to CWMs. The project involves evaluating the performance of pumps and other plant equipment, pipes, fittings, valves, instruments, and furnace-related components with CWMs supplied by several commercial vendors. The project also includes an evaluation of CWM corrosive and erosive properties, and the correlation of measured CWM physical and rheological properties with observed hydraulic behavior in pipes and fittings. These first project accomplishments are the subject of this paper. 4 references, 8 figures, 1 table.

10796 (CONF-850530—, pp 1057-1069) **Handling properties of coal water slurry fuels.** Dooher, J.P.; Cote, D.; DiMeo, D.; Malicki, N.; Wright, D. (Adelphi Univ., Garden City, NY). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The data presented in this paper is part of the second phase of an investigation in which the rheology, stability, and handling properties of six commercially available coal water slurry fuels (CWF) are examined. Funding was supplied by the Electric Power Research Institute, the Empire State Electric Energy Research Corporation, Florida Power and Light Company, the New York Power Authority, the New York State Energy Research and Development Authority, and the United States Department of Energy. In this paper, the high and low shear rheology of a typical highly-loaded CWF containing 70 weight percent solids is presented. In addition, tests performed under constant shear rate conditions using a Moyno progressing cavity pump, a Transamerica DeLaval externally timed twin screw pump, and a Hazleton centrifugal pump are discussed. High shear test results and constant shear centrifugal pump test results for a moderately-loaded CWF (approximately 54% solids) are also included in the paper. 16 figures.

10797 **(DOE/FE/60181—176) Sodium in low-rank coal.** Hurley, J.P. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Dec 1985. Contract FC21-83FE60181. 11p. (CONF-860219—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86003912.

From International coal testing conference; Lexington, KY, USA (11 Feb 1986).

An important parameter used to determine quality of many low-rank coals is the sodium content of the coal ash. During combustion sodium captures sulfur and forms a layer on boiler heat exchange surfaces that is the precursor to the formation of ash fouling deposits. Once the deposit starts to form, sodium acts as a fluxing agent to lower the melting point of ash particles which aids in binding the particles together to strengthen the deposit. The association of the sodium in the coal may aid in determining the association of the sodium in the deposit. However, because of the possibility of the volatilization of some inorganics that are associated with the organic matter in low-rank coals, the measurement of the sodium concentration in coal ash may not be truly indicative of the sodium concentration of the coal. Therefore, to accurately determine the effect of sodium on the formation of ash fouling deposits, it is suggested that the sodium concentration be measured directly in the coal by using acid digestion and subsequently analyzing the digest. 11 refs., 5 figs.

10798 **(DOE/PC/50801—12) Laser induced coal fluorescence. Twelfth quarterly technical progress report, July 1-September 31, 1985.** Borst, W.L. (Texas Tech Univ., Lubbock (USA)). 1985. Contract FG22-82PC50801. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004271.

The analysis of the two coal series resulted in the formulation of the working hypothesis that the two fluorescene lifetimes are coming from two different fluorophores: the first of these is common to the five maceral types studied (alginite, sporinite, cutinite, fluorinite, and resinite); and the second is transforming into the first component as the coal matures. This would explain the trends we saw in the five of the nine maceral types studied. The remaining four maceral types, showed more complex variations in the time-resolved parameters, which could not be explained at the present time. We hope that by studying the variation of the parameters with respect to the concentrations of various model solutions, these other trends in coal may be explained. We are currently studying the relationship between the relative concentration of component solutions and the time-resolved parameters A/sub i/ (the pre-exponential coefficients), T/sub i/ (the decay times) and P/sub i/ (component percentages). It is expected that these effects will explain some of the trends we have observed in coal. 2 figs.

10799 **(DOE/PC/70809—T4) Microbial screening test for lignite degradation. Quarterly progress report No. 4, October-December 1985.** Yen, T.F. (University of Southern California, Los Angeles (USA)). 1985. Contract FG22-84PC70809. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004559.

Chemical oxidation of lignite by means of hydrogen peroxide - acetic acid was executed. Methanol fractionation of the oxidized product yielded 76.4% methanol solubles, 9.3% methanol insolubles and 11.2% CO_2. Biodegradation of the methanol fraction by soil bacteria was found to be positive as demonstrated by gel permeation chromatography (GPC). The shift of the average molecular weight throughout biodegradation was estimated to be from 310 g/mole, to 243 g/mole, zero day and four weeks respectively. Biodegradation of lignitic substrates, benzene - methanol fraction (A - 1), aqueous alkaline fraction (A - 2), clean lignite residue (A - 3), raw lignite, and methanol soluble fraction after oxidation, by means of oil - field soil bacteria and Polyporus versicolor ATCC 12679 was attempted. All previous mentioned lignitic substrates yielded positive results for oil-field soil bacteria, while A - 2 fraction and raw lignite yielded positive results for P. versicolor. Unidentified fungi strains, N 1, L 1, and L 2 were also tested on lignitic substrates. Mild growth was observed in these cases.

10800 **(ERP/CRL—84-23) Coal strength parameters derived for the No. 1 (Scott Pitt) seam, Drummond mine, Westville, NS.** Aston, T.R.C.; O'Leary, L.S.; O'Brien, D.J. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Jul 1984. 26p. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

As part of ongoing geotechnical research activities at the Cape Breton Coal Research Laboratory, samples were collected from the No.1 (Scott Pitt) seam at the Drummond Mine, Westville, Nova Scotia. A programme of irregular lump point load testing was undertaken and uniaxial and tensile strength parameters derived. Strength values are given both parallel and perpendicular to the bedding plane and an anisotropy index calculated. A preliminary comparison between the Pictou and Sydney coalfield data reveals that the Drummond coal properties closely resemble those obtained from Prince Mine. (5 refs.)

10801 **(NP—6770070) Investigation of trace elements in domestic coal and its combustion products, as well as in industrial samples and ashes of special refuse by means of neutron activation analysis.** Molla-Djafari, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). Aug 1983. 134p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE86770070.

In this paper, investigations of nine different sorts of coal from the Austrian market, their respective residual ashes and smoke condensatetes are presented. In addition, five industrial samples, consisting of industrial coal, residual ash and filter ash from the coal-fired power plant of Voitsberg, residual ash and fly ash from an industrial waste incineration plant and 27 residual ash samples from the same incineration plant have been analyzed by neutron activation analysis (NAA) for trace elements. In coal and its incineration products 28 elements from the following list could be determined: As, As, Br, Ca, Ce, Cl, Co, Cr, Cs, Cu, Dy, En, Fe, Ga, Ir, J, K, La, Lu, Mg, Mn, Na, Sb, Sc, Se, Sm, Ta, Th, Ti, U, V. In industrial samples and residual ashes from industrial waste, up to 31 elements from the following list could be determined: Ag, Al, Au, Ba, Br, Cd, Ce, Cl, Co, Cr, Cs, Cu, Dy, Eu, F, Fe, Ga, Hf, In, Ir, J, K, La, Lu, Mg, Mn, Mo, Na, Pb, Rb, Sb, Sc, Se, Sm, Ta, Th, Ti, U, V, W, Zn.

0108 Waste Management

REFER ALSO TO CITATION(S) 10765, 10776, 10879, 10906, 10907, 11219, 11220, 11221

10802 (DOE/ET/17086—1932, pp 3.79-3.95) **Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas.** Groenewold, G.H.; Rehm, B.W. (Univ. of North Dakota, Grand Forks; North Dakota Geological Survey, Grand Forks). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

Fly ash and FGD waste constitute the two major solid by-products of coal-burning power plants. Emplacement of these wastes in mined areas is a common method of disposal at mine-mouth operations. An ongoing project is evaluating the potential impacts of these wastes on groundwater quality at the Center Mine near Center, North Dakota. The fly ash and FGD waste are generated by Unit No. 2 of the Milton R. Young Station. The FGD waste is generated by using the fly ash as an SO_2 sorbent. FGD waste from the Milton R. Young Station, when placed in contact with water in column experiments, generates leach fluids with high SO_4 and other major ions and pH within the range of natural groundwater. The degree of ion pairing and complexing of SO_4 with Na and Mg determines the solubility of gypsum accounting for the high concentrations of SO_4. With the exception of molybdenum, toxic metal and non-metal concentrations in FGD waste leachate are typically not in excess of drinking water standards. Fly ash from the Milton R. Young Station, when placed in contact with water in column experiments, reacts very similarly to the FGD waste with respect to major ion trends. In contrast to FGD waste, the pH of fly ash column effluent is typically within the range of 10.5 to 12.0 and concentrations of toxic metals and non-metals are often in excess of drinking water standards. Analyses of groundwater samples from piezometers in and near buried fly ash and FGD waste at the Center Mine suggest considerable similarity, with respect to all parameters, between groundwater quality and trends in disposal sites and the quality and trends of effluent from column studies. 7 refs., 4 figs.

10803 (DOE/MC/19352—1763) **Anaerobic treatment of gasifier effluents. Final report.** Suidan, M.T.; Pfeffer, J.T.; Wang, Y.T.; Deady, M.A.; Fox, P.; Kao, S.W.; Johnson, M.A. (Illinois Univ., Urbana (USA). Dept. of Civil Engineering). Jun 1985. Contract AC21-82MC19352. 141p. NTIS, PC A07/MF A01; GPO Dep. File Number DE86001015.

An evaluation of the technical feasibility of using the completely mixed, expanded-bed granular activated carbon (GAC) anaerobic filter for the treatment of real and synthetic coal gasification wastewaters is presented. The treatment of both coal gasification wastewaters revealed that inhibition to the biological processes occurred after the breakthrough of some of the compounds present in the wastewaters. This inhibition was controlled through the use of a carbon replacement schedule. A fraction of the GAC medium was periodically withdrawn from the anaerobic filter and replaced with virgin activated carbon. This strategy appeared to be effective in maintaining the effluent levels of the toxic compounds at below inhibitory concentrations. 54 refs., 30 figs., 20 tabs.

10804 (DOE/PC/80512—T3) **Anaerobic SBR treatment of coal conversion wastewaters. First quarterly report.** Ketchum, L.H. Jr. (Notre Dame Univ., IN (USA). Dept. of Civil Engineering). 20 Dec 1985. Contract FG22-85PC80512. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004262.

A synthetic wastewater, with appropriate nutrients and vitamins needed by mixed anaerobic cultures, has been selected. The pollutants selected represent the major categories of constituents found in coal conversion wastewaters. The serum bottles and associated supplies to conduct the screening tests has been obtained, and six 2-L Jug Reactor systems have been constructed. The acclimation studies will begin in January 1986, using organisms obtained from six different sludges. 2 refs., 1 fig., 1 tab.

10805 **Crystallization behavior of coal gasification ash.** Federer, J.I.; Lauf, R.J. (Oak Ridge National Lab., TN). *Nuclear and Chemical Waste Management;* **5**: 221-229(1985).

Large-scale commercialization of coal gasification would result in large volumes of ash or slag requiring disposal. Burial of ash or slag raises environmental concerns because of the possible leachability of harmful trace elements into groundwater. In this study, Hygas ash was melted as a means of reducing the volume for disposal. The crystallization behavior of melted ash (slag) and other slags modified to lower the melting temperatures was determined. The principal constituents of Hygas ash were Al_2O_3, SiO_2, and Fe_2O_3 with low alkali and alkaline earth content and small concentrations of other elements. This material melted at 1400°C and recrystallized by rejection of iron oxides from a silicate glass. Increasing the Na_2O content to 37 wt% resulted in a totally glassy structure and a lowering of the melting temperature to about 850°C. Limited leaching tests indicated that the leachability of melted Hygas ash and modified slags increased substantially with increasing Na_2O content. 8 references, 5 figures, 4 tables.

10806 **Potential resources from coal fly ash.** Watson, J.S. (Oak Ridge National Lab., TN). *Materials Research Society Symposia Proceedings;* **43**: 151-161(1985). Contract AC05-84OR21400.

Recent studies at Oak Ridge National Laboratory (ORNL) and elsewhere have identified various chemical processes for recovering useful materials, such as alumina and iron oxides, from coal-composition fly ash. Based on certain assumptions, each of these processes can yield useful products at economical prices. Most processes leave a residual solid waste with a volume only slightly less than that of the original waste. This residue may not present a serious hazard, but its volume alone makes disposal difficult for utilities with limited land available for disposal sites. Characteristics of some of the residues are being studied to determine possible beneficial uses or applications of these by-products. 15 references, 2 figures, 4 tables.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 10772, 10802, 10848, 10875, 10879, 10880, 10886, 10887, 10888

10807 (CONF-850530—, pp 558-567) **Size and composition of particulate emissions from the combustion of coal slurries.** Zronek, S.C.; Savage, R.L. (Ohio Univ., Athens). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The combustion of coal/oil/water slurries was compared with the combustion of No. 6 fuel oil to help develop a better understanding of emission characteristics and the variables which affect the particle size distribution, and the carbon and sulfur content of the fly-ash. The size distribution of emission particulates measured at various primary and secondary air ratios and fuel temperatures showed the effect of boiler excess air level and fuel atomization conditions. A 32.5:45.5:22.0 percent coal/oil/water (COW) mixture was burned at high fire (6 lb/min) and low fire (3.4 lb/min) to compare stack gas loading and emission variations. The coal in the slurry was 91% less than 325 mesh (44 microns) with an average sub-sieve particle size of 4.2 microns. In the investigation, the particulate size distributions were measured using a modified Mark III High Temperature 8 Stage Cascade Impactor System. The fuel was fired in a 150 H.P. Cleaver Brooks fire tube industrial boiler, and the stack gas composition was analyzed using an on-line Perkin Elmer 1200 mass spectrometer in series with a Chemiluminescent NO-NO_2-NO/sub x/ Analyzer. The ultimate analysis of the particulates for carbon, hydrogen, and nitrogen was done with a Perkin Elmer 240C Elemental Analyzer. A scanning electron microscope (SEM) was used to observe the size distribution of the emission particulates from the combustion of No.6 fuel oil at various boiler operating conditions and of coal/oil/water mixtures. An elemental analysis of the particulate composition was determined by energy dispersive X-ray (EDX). 3 references, 11 figures, 6 tables.

10808 (DOE/METC—85/5, pp 163-177) **Techniques used in the determination of the areal extent of organic contamination at the US DOE Hoe Creek underground gasification site.** McTernan, E.M.; Davidson, S.C. (Western Research Institute, Laramie, Wyoming). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The introduction of organic compounds into the groundwaters during and following three underground coal gasification experiments at the US DOE Hoe Creek site was established by a groundwater monitoring program conducted by Lawrence Livermore National Laboratory 1976 through 1982. The measurement of phenols was used as an indicator of change in concentration and apparent migration of organic contamination. In mid 1980, elevated levels of phenols were detected in well WS 14, completed in the Felix 1 coal seam, on the eastern boundary of the site. A field reconnaissance program was developed by the Western Research Institute (WRI) for the DOE, based on the following objectives: establish the areal extent of organic contamination in all directions and install monitor wells; determine if organic contamination had moved off-site to the east; and provide monitoring wells which would allow assessment of contamination migration rates. The program utilized a colorimetric phenol analysis of composite water samples from drill holes to determine if organic contamination had been intersected and to position monitor wells. Phenol concentrations found in the composite samples obtained during the drill program indicated organic contamination had spread to the north, west, south, and east of each burn, but did not appear to have extended off-site. Contamination to the north and west was more extensive than expected. A subsequent sampling of the twenty new monitor wells indicated that contamination was present in the Felix 2 coal seam off-site to the east.

10809 (DOE/METC—85/5, pp 227-241) **Site characterization and environmental monitoring approach for UCG research and development in bituminous coals.** Cooke, S.D.; Cooper, L.M.; Byrer, C.W. (Oak Ridge Associated Universities, TN). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

The importance of conducting site characterization studies and environmental monitoring at underground coal gasification (UCG) field tests has evolved primarily through experience gained from previously conducted experimental field projects. Based on these experiences, criteria are suggested for assessing the geologic and hydrologic compatibility of proposed test sites relative to bituminous UCG process requirements. These criteria include the characterization of potentially suitable sites and subsequent monitoring procedures for the physical and chemical environments of those sites.

10810 (PB—85-235455/XAB) **First observations of ecological surveillance plots on afforested open-cast spoil in South Wales. Occasional paper.** Dawkins, H.C.; Hockin, R.L.; Power, J.D. (Oxford Univ. (UK). Commonwealth Forestry Inst.). 1985. 72p. (CFI/OP—25). NTIS, PC A04/MF A01.

The object of the project was to initiate a long-term study of the development of soil, vegetation, and fauna on restored, afforested open-cast sites in the South Wales coalfield. Four afforested sites were selected out of nine botanically surveyed, and thirty-two plots were placed within them to represent the range of age and apparent site quality that was evident in 1980. Plots were 20 x 20m squares, each divided into four 10 x 10m subplots. A diagonal pair of these was allocated for botanical observation, and the other diagonal pair was left for activities where disturbance might be necessary, such as soil and faunal sampling.

10811 (PB—85-237923/XAB) **Control of acid mine drainage. Proceedings of a technology-transfer seminar. Information circular/1985.** (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1985. 67p. (BM-IC—9027). NTIS, PC A04/MF A01.

Acid mine drainage can be controlled by water treatment, retardation of the pyrite oxidation reaction system, or enhanced prediction that allows preventive action to be taken. The Bureau of Mines is conducting research in each of these areas; the results of the research are summarized in the eight papers that comprise the volume. Fieldwork to evaluate overburden analysis, alkaline injection, and bactericidal control of acid formation is described, along with two new inexpensive methods to treat acid mine water. These papers were prepared for an acid mine drainage technology transfer meeting held in Pittsburgh, PA, on April 3 and 4, 1985.

10812 **Fluoride emissions of coal-fired power plants and their impact upon plant and animal species.** Tourangeau, P.C.; Gordon, C.C.; Carlson, C.E. *Fluoride;* **10**: No. 2, 45-94(Apr 1977).

The 40 lbs/day fluoride emissions from the Billings 180-megawatt coal-fired plant are substantial enough to accumulate at excessive levels to cause an impact upon the foliage of ponderosa pine and to increase the fluoride levels in the femurs of deer mice. The 40 lbs/day fluoride emissions from the Colstrip Units #1 and #2 will be released from 525 ft (161 meters) stacks and thus not fumigate and damage as seriously the ponderosa pine foliage of that area as at the Billings sites. Past pre-operational baseline studies in the Colstrip area and the scavenging ability and partitioning of fluorides in the different portions of the needles of ponderosa pine indicate that the geographical extent of the trespass of Units #1 and #2 plume will not be difficult to evaluate in the future. 14 figures, 2 tables.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 10917

10813 (CEER-X—163, pp vp) **Peat - a viable alternative for energy production.** Edelman, R.A.; Bongiorno, S.J. (Burns and Roe, Inc., Oradell, NJ). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The worldwide distribution of peat, estimated to cover 500 million hectares of the earth's surface, establishes peat as a major energy resource. Many countries with limited conventional fossil fuels have sufficient peat to affect their individual economies. Data on worldwide peat resources and current resource recovery and utilization practices are reviewed. The viability of direct combustion of peat for electric power generation in the US has been addressed by Burns and Roe in a study sponsored by the Electric Power Research Institute. The results of technical and economic evaluations of peat harvesting, drying, transportation, and combustion are described. Specific techniques and equipment requirements for large-scale peat harvesting operations are identified. 6 references, 8 figures, 4 tables.

10814 (ERP/CRL—84-37) **Coal reserves in Canada: 1983.** Naidu, H.G. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Nov 1984. 35p. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

This report updates the coal reserves in Canada, the tonnages and quality data to December 1983. Major sections covered are: current reserves by province/coal region/coalfield, coal reserves by rank, coal reserves by likely mining method, and production and operating coal mines and projects under development as of December 31, 1983. (12 refs.)

0120 Mining

REFER ALSO TO CITATION(S) 10813, 10814

10815 (DOE/EIA—0125(85/3Q)) Coal distribution, January-September 1985. McNair, M.B. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 2 Jan 1986. 100p. NTIS, PC A05/MF A01 - GPO; GPO Dep. File Number DE86004926.

This Energy Information Administration (EIA) report continues the quarterly series on coal distribution started in 1957 by the Bureau of Mines, Department of the Interior, as a Mineral Industry Survey, Distribution of Bituminous Coal and Lignite Shipments. The publication provides volume data on coal distribution by coal-producing district of origin, consumer use, method of transportation, and state of destination necessary for EIA to fulfill its data collection functions as authorized by the Federal Energy Administration Act of 1974 (Public Law 93-275, Sections 5 and 13, as amended). The report is widely distributed to federal and state agencies, the coal industry, and the general public. All data for 1985 in this report are preliminary. Data for 1981 to 1984 are final. US coal distribution to domestic and foreign markets totaled 662.0 million short tons in the first 9 months of 1985. This was 4.4 percent below coal shipments in the first 9 months of 1984, but 14.2 percent above the depressed levels of the comparable period in 1983. 6 figs., 33 tabs.

10816 (DOE/EIA—0218(86/01)) Weekly coal production, January 4, 1986. (USDOE Energy Information Administration, Washington, DC). 16 Jan 1986. 4p. NTIS, PC A02/MF A01 - GPO; GPO Dep. File Number DE86005242.

This publication is available from the Superintendent of Documents, US Government Printing Office (GPO). Ordering information and purchase of this and other Energy Information Administration (EIA) publications may be obtained from the GPO or the EIA's National Energy Information Center (NEIC). Questions on energy statistics should be directed to the NEIC. Addresses and telephone numbers appear below. National Energy Information Center, EI-20, Energy Information Administration, Forrestal Building, Room 1F-048, Washington DC 20585 (202) 252-8800 or Superintendent of Documents, US Government Printing Office, Washington, DC 20402 (202) 783-3238

10817 (ERP/CRL—84-044) System for gathering dragline data using an electronic data logger and modem. Stuart, N.J. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Dec 1984. 40p. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

To facilitate operations research into surface mining methods, time study data on draglines were required. This study details the development of a system that records events by manual entry on a purpose built keyboard. The data are stored in a microprocessor based data logger and transmitted daily to the laboratory computer via an acoustic modem. Programs were written to analyse the data files and produce statistical summaries outlining the relationships between parameters such as the dragline swing angle and the expected time to complete an operation (e.g. mean swing time).

10818 (ERP/CRL—85-4) Research oriented technological needs in the Sydney coalfield. Stewart, D.B. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Jan 1985. 9p. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

In this report identification is made of the major technological needs of the Sydney, Nova Scotia, coalfield with an emphasis on the site specific issues which must be resolved by local action. The emphasis is on research as opposed to operational needs. The technological needs covered are in the areas of: 1) the mine environment, 2) geotechnical aspects, and 3) equipment.

10819 (ERP/CRL—85-12) Strata control investigations in the Sydney coalfield - Annual report, January 1 to December 31, 1984. Aston, T.R.C.; Cain, P.; Gallant, W.D.; O'Leary, L.S. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Jan 1985. 25p. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

A review is presented of work undertaken by the Strata Mechanics group of the Cape Breton Coal Research Lab, CANMET, for the period of 1984. A brief description of the research activities undertaken in the Lingan, No. 26 and Donkin-Morien mines is provided as well as results obtained and the current status of other ongoing research programs in this coalfield. The major programs include: gateroad deformation and gob leakage, barrier pillar design criteria, outburst research, evaluation of undersea subsidence criteria, rock/support interaction program, rock/support interaction in tunnel borers, and instrumentation-development/testing. Minor programs are listed. (17 refs.)

10820 (ERP/CRL—85-18) Empirical methods of support design for the Sydney coalfield. Cain, P. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Mar 1985. 15p. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

Support design methods can be divided into two categories: theoretical and empirical. Empirical methods can range from no more than an accepted 'rule of thumb' derived from operating experience at a particular location, to full statistical analysis of a number of observations made either worldwide or in a particular mining camp. These methods have the advantage that the large number of indeterminate factors which cannot be incorporated into a numeric model are included in the empirical model without necessarily being individually assessed. This paper reviews some empirical design methods currently in use, and explores their possible role in the design of coal mines in the Sydney Coalfield of Cape Breton Island, Nova Scotia. (8 refs.)

10821 (MRP/MRL—84-89) Strength and deformation properties of various rocks from the Springhill coal mine, Nova Scotia. Betournay, M. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Sep 1984. 34p. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

A testing program was undertaken to subject several specimens of varying rock types to uniaxial and triaxial compression tests to quantify the behaviour of these units for application in new underground mine development. Originating from the Springhill Mine, Nova Scotia, four distinct rock types from eight lithological units were subjected to multiple failure state tests. The mudstones (tested moist) displayed various strengths depending on the number of fissile discontinuities present in the sample before testing, and failure was in a blocky fashion using these discontinuities. The sandstones (containing varying amounts of coal) from final units show a difference in strength, and the influence of the coal on the failure mode depended on the orientation of the coal and its concentration. The strength and failure mode of the siltstones (tested moist) depended on the clay vs. silt grain size distribution. The coal sample failed at low strength with high displacements due to dislocations of weak planes. (2 refs.)

10822 (MRP/MRL—84-90) Study of rock behaviour for the Donkin-Morien rock/support interaction contract. Betournay, M. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Sep 1984. 27p. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

A testing program was established to subject several specimens from the Donkin/Morien coal mine of varying rock types to uniaxial and triaxial compression tests, as well as to tensile tests. Both compression and tensile tests were performed on sandstones, mudstones, siltstones, and gradational types. The sandy-siltstone was strongest followed by the sandstone, silty-mudstone, mixed siltstone and mudstone. Specimens from gradational units were stronger when the amount of silt was high. (2 refs.)

10823 **(PB—85-236404/XAB) Remedial and stratareplacement techniques on longwall faces. Report on the state of the art. Information Circular/1985.** Dalzell, R.S.; Curth, E.A. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1985. 37p. NTIS, PC A03/MF A01.

The problem of longwall roof control is addressed. The report presents a review of foreign remedial and strata replacement techniques for longwall faces and evaluates their potential for domestic application. The technology reviewed includes meshing, chemical rock stabilization, cribbing, strain-absorbent modules, inflatables, synthetic foams, and monolithic fills.

10824 **(PB—85-239986/XAB) Design of bulkheads for controlling water in underground mines. Information Circular/1985.** Chekan, G.J. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1985. 44p. (BM-IC—9020). NTIS, PC A03/MF A01.

The Bureau of Mines report presents three methods for designing bulkheads to impound water underground: (1) thin and thick plate design; (2) South African plug design; and (3) single and double bulkhead seal design. Related areas critical to the long-term effectiveness of underground water impoundments are also addressed. These include bulk-head anchorage, concrete specifications and placement, the grouting of permeable strata, and the sizing of barrier pillars. A case study involving hydrostatic tests conducted on a single bulkhead seal constructed in the Safety Research Coal Mine of the Bureau's Pittsburgh Research Center is presented in an appendix.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 10813, 10861, 10886, 10914, 10915, 11764

10825 **(BCRNL-L—1525) Evaluation of the effect of coal cleaning on fugitive elements. Phase IV. Identification of mineral forms in coal. Quarterly progress report No. 10, September 1-November 30, 1985.** Streeter, R.C. (Bituminous Coal Research, Inc., Monroeville, PA (USA). National Lab.). 20 Dec 1985. Contract AC22-83PC62690. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005005.

Identification of mineral forms in the various feed and product coal samples received to date will be facilitated by updated determinations of matrix flushing constants for 15 mineral standards at 2Θ angles in the range of 2 to 48°. The recently received CP product coal sample was analyzed for major elements in the ash. Comparison of these results with those for the earlier AP coal sample (from the same seam) showed significantly lower amounts of SiO_2, Al_2O_3, and TiO_2 in the CP sample, as well as higher amounts of the alkali metal oxides. There was also a discrepancy of approximately 10 weight percent in the ash material balance, similar to the results for the AP sample. 2 tabs.

10826 (CONF-850530—, pp 256-267) **New way to handle pulverized coal: the pumpable coal/water/air mixtures (C-WAM).** Antonini, G.; Francois, O.; Gomont, J.; Touret, A.; Framatome, G.S. (Universite de Technologie de Compiegne, France). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The dispersion of pulverized coal in water, leading to the so-called CWS, brings some problems, e.g. the settling of coal in water, the difficulties in reaching high solid contents, and the high viscosities of the resulting CWS. This paper deals with a new solution involving water in the form of an aqueous foam acting as a suspending medium for the pulverized coal. The resulting coal/water/air mixture (C-WAM) is a perfectly non-settling slurry, easy to prepare both in a continuous or discontinuous process, and easily pumpable owing to its fluidity. One of the main characteristics of the C-WAM is the possibility of a 75% coal by weight slurry by using a conventional mixing device. With C-WAM, any kind of coal particle size distributions may be used (if not too coarse, i.e. less than 500 μm). As a result, the overall preparation cost (mixing plus grinding) is much lower with C-WAM, than for the equivalent conventional 75% CWS. The continuous preparation process of C-WAM described in the paper uses a 1-ton per hour installation. The C-WAM needs additives for the foam preparation and its stabilization. The foaming agent, usually cheap because already on large scale production, may be chosen among a wide variety of chemical products. Aside from additives considerations and preparation process, the paper presents the pumping characteristics of C-WAM on two different pump loops: the first one, with flow rates ranging from 0.1 to 1 cubic meter per hour, and the tube inside diameter of 2.5 cm (1 inch); the second, with flow rates ranging from 10 to 35 cubic meters per hour and tube inside diameter of 0.1 m (4 inches), and 0.05 m (2 inches). 2 references, 6 figures.

10827 (CONF-850530—, pp 268-281) **Production and combustion of hot-water-dried lignite slurries.** Hauserman, W.B.; Patel, R.C.; Willson, W.G. (Univ. of North Dakota Energy Research Center, Grand Forks). 1985. NTIS, PC A99/MF A01. File Number DE85012244. Contract FC21-83FE60181.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Low-rank coal water slurries can be produced by hydrothermal processing (hot-water drying). A unique property of lignites is that when particles are heated above about 270°C in water, their internal moisture is expelled and is not re-absorbed upon cooling. Thus lignite of over 40% moisture can be converted to coal containing less than 10% moisture, and water will not be absorbed, even though the particles are immersed in water. A similar effect is achieved with saturated steam. The practical result is that low-rank coals can be converted to pumpable slurries with a heating value approaching that of the raw coal or that of bituminous coal slurries prepared without additives. Significant amounts of ash, especially soluble alkalis and some sulfur compounds are removed during hydrothermal processing, thus augmenting any beneficiation step that may be used along with hot water drying. Not all that happens to the micro-structure of lignite during hydrothermal processing is known. However, there is a significant decrease in the surface area. The particle size distribution shifts downward by some combination of shrinkage and attrition. A slurry made from hot-water-dried Indian Head lignite becomes more stable and does not settle, even without additives. Another change is that the viscosity is greatly reduced, enabling increased solids loading. The specific goals of pilot scale programs in progress at UNDERC are to demonstrate the production of concentrated hot-water-dried low-rank coal water slurries, to generate process engineering data, and to produce quantities of the slurry to permit characterization of its combustion behavior. 19 references, 14 figures, 1 table.

10828 (CONF-850530—, pp 306-315) **Coal beneficiation by expansion of a supercritical coal/water slurry.** Carli, G. (Foster Wheeler Development Corp., Livingston, NJ). 1985. NTIS, PC A99/MF A01. File Number DE85012244. Contract AC22-83PC60415.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

This paper summarizes the results of the work done during a DOE-funded study to prepare a conceptual design of a Superfine Coal Cleaning System (SCCS) and evaluate its technical and economic feasibility. In the SCCS, a slurry of coal and water is pressurized, heated to supercritical conditions and rapidly expanded to near atmospheric conditions. The fluid entrapped in the pores of the coal explosively comminutes (shatters) the coal into a superfine condition while leaving the mineral/ash size fraction essentially unchanged. Thus the explosive shattering force selectively reduces the mean particle size of the hydrocarbonic portion but not the mean particle size of the undesired ash-forming mineral portion of the raw feed coal. The result is a steam-entrained particle mixture with two distinct size and density fractions - light superfine coal and coarser, markedly heavier, ash-forming mineral particles. By passing the mixture through a cyclone separator, the mineral/ash fraction can be collected and the steam/superfine coal mixture allowed to pass to the steam generator coal burners. According to the inventors, this process can remove 75% of the minerals and 85% of the sulfur contained in the feed coal. 6 references, 2 figures, 6 tables.

10829 (CONF-850530—, pp 316-324) **Chlorinated solvents for coal beneficiating.** Nankee, R.J. (Dow Chemical Co., Midland, MI). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The use of organic parting liquids to separate coal from associated heavy impurities is common practice in the laboratory analysis of raw coal samples. Full-scale heavy media coal cleaning processes, however, have traditionally relied upon the use of suspensions, rather than true heavy liquids, as separating media. By far the most commonly used separating media consists of finely ground particles of iron ore suspended in water, but as the coal particle size approaches that of the magnetite, separation efficiency is lost. This paper describes recent, on-going efforts to develop commercial coal beneficiation processes utilizing various chlorinated solvents as separating media. Dow's efforts to help meet the challenges by beneficiating coal include true heavy media gravity separations with chlorinated solvents and liquid/liquid partitioning processes and Dow Solvent Recovery Technology to recover the solvent from both product (or floats) and rejects (sinks). Objectives of the efforts to clean coal are to reduce sulfur, reduce ash, and increase the Btu's/pound. In this paper, the solvents are described; a general flow diagram presented; some of the results on upgrading various coals described, and projected costs of full-scale plants using chlorinated solvents are compared to plants with conventional cleaning devices. The chlorinated solvents used in this work are methylene chloride, 1,1,1-trichloroethane, trichloroethylene, and perchloroethylene. 2 figures, 4 tables.

10830 (CONF-850530—, pp 325-332) **Approach to deashing of some Chinese coals by oil-agglomeration method.** Guo, C.T.; Li, S.F.; Ruan, X.Q.; Li, F.Y. (Tianjin Univ., China). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The oil-agglomeration process provides an attractive method for deashing of fine powdered coals in the case of preparing COM (Coal Oil Mixture). The oil used for agglomeration can be the same one as used for COM processing. Perhaps, this is one of the most beneficial points in application of oil-agglomeration for practice. The present paper describes the deashing of some Chinese coals by oil-agglomeration in laboratory conditions for the purpose of preparing low-ash COM. The effects of various operating variables, e.g. particle size of coal, oil dose, slurry density, surfactant addition were investigated with reference to three Chinese coals. In addition, five different oils were used as agglomerating agent. For commercial application of the oil-agglomeration technique on any particular raw coal, this type of preliminary laboratory study is necessary in order to determine the selection and sizing of processing equipment. 9 references, 7 figures, 5 tables.

10831 (CONF-850530—, pp 333-339) **Coal-sludge mixtures - a sensible coal slurry fuel.** Ashworth, R.A. (Florida Progress Corp., St. Petersburg). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Coal slurry fuel mixture commercialization efforts are directly affected by the price of other alternative fuels. Economics prevail, and coal slurry fuel mixtures are not exempt from this basic prerequisite to commercialization. Florida Progress Corporation has developed and patented, US Patent No. 4,405,332, a novel concept to improve the economics of coal-aqueous fuel mixtures and at the same time address a growing environmental problem for large municipalities. The concept is based on the use of sewage sludge as the aqueous component to provide a pumpable coal-sewage sludge fuel mixture. The replacement of water by sewage sludge (94-98 wt percent water) as the aqueous component in such fuel mixtures improves economics and at the same time tends to mitigate certain environmental problems. Economics are improved due to elimination or reduction of the cost of chemical additives normally required for coal-water fuel mixtures. Also, the user of such fuels should receive a tipping fee from the municipality for disposal of its sludge; fees of $150 or more per dry ton are common for disposal of sewage sludge for densely populated areas on the East Coast. In addition, the use of a waste water such as sewage sludge rather than fresh water, eliminates the need to use fresh indigenous water supplies for coal-aqueous fuel mixture plants. Further, and most significantly the combustion of sewage sludge eliminates the disposal problems associated with current practices of land-filling and ocean dumping of sludge. 2 figures, 4 tables.

10832 (CONF-850530—, pp 717-729) **Use of high pressure water jets as a high efficiency tool for coal comminution.** Mazurkiewicz, M.; Summers, D.A. (Univ. of Missouri, Rolla). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The advantages of using high pressure water jets as a new technique for breaking coal into particles of an ultra fine size distribution are reviewed in this paper. The results of a preliminary investigation of the technique, carried out in the High Pressure Waterjet Laboratory of the University of Missouri-Rolla, are presented. These data indicate that the lower levels of energy required of this comminution process, in contrast to that required by conventional technology, improve the practical viability of using fine powdered coal in industrial processes, when the waterjet comminution is included in the grinding cycle. The compressive stress mode of failure induced in conventional milling processes is changed in waterjet comminution to a tensile failure by extension of existing particle boundaries, and the benefits of this change in failure mode are reviewed. 9 references, 8 figures.

10833 (CONF-850530—, pp 800-809) **Advance of SSCT's CWF project in China.** Wang, Z.; Hao, F.; Cen, K.; Zhang, R.; Zhang, Z.; Kou, C. (China Association for Coal Processing and Utilization, Haidian, Beijing). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Since the commission of the CWF Project sponsored by the State Science and Technology Commission and supported by the Ministry of Coal Industry in the beginning of 1983, large amounts of R and D work have been carried out, some aspects of which had been presented at the 6th Symposium. In the last year more fundamental work both on CWF preparation and combustion were performed and experiments of larger scale demonstrated. This paper reviews the general advance of the Project and outlines work to be done in the coming year. 8 references, 2 figures, 4 tables.

10834 (CONF-850530—, pp 828-835) **Demonstration and various test applications of COM in Israel.** Keren, M.; Wetzstein, M. (Coal United Company Ltd., Haifa, Israel). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

A summary of the experience gained in COM production and firing in a fire tube boiler is given. Construction details of a portable rig for testing COM at various locations and different firing applications are also included. In March 1984 the retrofit work of the demonstration boiler and the installation of a portable mix plant were completed. Start-up trials of the mix plant and the boiler lead to some changes in the original design especially in the burner tip, atomization temperature, COM delivery set-up and pulverized coal feeding system. Areas in which COM will be tested include: cement production, lime kiln, potassium nitrate drying, phosphate calcining and potash drying. As a preparation for the series of tests, some upgrading of the demo mix plant is planned together with construction of a portable rig which will be transferred to the customer site and will set a parallel feed line of COM to the burner. The rig will be fed by road tankers shuttling between the site and the COM temporary storage tank. Tailored burner tip adjustments for the test are planned for each application and a variety of burner application results for COM are expected to be gained on completion of the tests. Test objectives include proper atomization, flame pattern, ease of general operation, continuity and product contamination. 1 reference, 6 figures, 2 tables.

10835 (CONF-850530—, pp 874-882) **Design considerations for coal-water slurry handling systems at utility and industrial plants.** Causilla, H.; Liu, E.H. (Bechtel Power Corp., Gaithersburg, MD). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

This paper discusses the design considerations and engineering aspects of equipment selection, piping layout design, piping flushing and cleaning, valve selection and other facilities necessary to feed, transport, and store the CWS on site for a potential plant. This paper also discusses potential waste disposal schemes associated with the handling of the CWS fuel. System configuration and operation are addressed by presenting a typical CWS onsite handling system. The system includes CWS unloading, storage, and transfer facilities. Alternate types of pipe cleaning systems are discussed; e.g., flushing and air blowing and air-operated pig cleaning systems. To address the equipment selection and system design rationale, component-to-component discussions are offered in this paper based on the configuration stated in the system description section. 8 references, 4 figures, 1 table.

10836 (CONF-850530—, pp 905-912) **Progress in the design of coal-water fuel plants.** Carlton, C.H.; Reed, R.R. (Bechtel Power Corp., Gaithersburg, MD). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Over the past year, Bechtel Power Corporation performed a number of site specific coal-water fuel (CWF) plant designs and cost estimates based on the Atlantic Research Corporation ARC-COAL process. Atlantic Research Corporation and Bechtel Power Corporation recognized that their respective special knowledge and abilities applicable to the production and use of coal-water fuels (CWF) are complimentary. The two companies entered into a joint CWF Marketing Agreement with the purpose of developing projects to produce and utilize CWF. This team effort is aimed at industrial and electrical generating facilities. Planned cooperation includes the design, construction, and operation of CWF production plants and the conversion of customer facilities to the use of ARC-COAL. As the marketing plan identified clients with varying CWF use rates in various locations, designs for several production plants had to be developed in order to define capital requirements and operating costs. Capacities of the plants varied from 2600 to 25,000 barrels per day (bpd) and geographic locations ranged from Florida to Canada. This paper discusses the progress made in the design of CWF plants and problems encountered. The costs and construction schedules for different production plants sizes and locations are summarized.

10837 (CONF-850530—, pp 913-920) **Slurry characteristics of various oversea coal bases on the pilot scale test.** Nakabayashi, Y.; Kimura, N. (Electric Power Development Company Ltd., Tokyo, Japan). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The Electric Power Development Co., Ltd. (EPDC) has long been working on construction of coal-fired electric power plants, and on the development of technology for receiving large quantities of coal from overseas and for solving the environmental problems associated with coal. Since 1975 work has been in progress on developing technology to handle coal in liquid form so that it can be handled in a manner similar to petroleum. EPDC has nearly completed its research and development work on coal-oil mixtures (COM). The next stage, research and development on a highly loaded coal-water slurry (HCWS), is now in progress. In addition, since EPCD is not merely an electric power company but also a large-scale user of coal, work is proceeding on a high efficiency coal transportation system, involving both land and sea transportation of coal from the mine to the power plant. Not only must handling problems be solved, but the system must be highly economical. Results to date are discussed. 5 figures, 5 tables.

10838 (CONF-850530—, pp 921-932) **Preparation test of HCWS at a pilot plant in 1984.** Sato, N.; Sakata, M.; Suzuki, N.; Katahata, T. (Kawasaki Heavy Industries, Ltd., Tokyo, Japan). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The research and development of Highly Loaded Coal Water Slurry (HCWS) as a Japanese national project is in the pilot plant test stage at present. Electric Power Development Co., (EPDC) is conducting the tests and research with participation of several leading plant manufacturing and additive makers. HCWS preparation plant which had been designed and manufactured by Kawasaki Heavy Industries Ltd. was constructed at EPDC's Wakamatsu Coal Utilization Technology Research Center. HCWS preparation tests have been under way at this plant since 1983. Outlined in this report are the HCWS preparation tests that were conducted in 1984 by using this HCWS preparation pilot plant. 8 figures, 5 tables.

10839 (CONF-850530—, pp 934-949) **Slurry characteristics of CWS with Highcoal F-3225 in pilot scale production test.** Naka, A.; Honjo, S.; Sugiyama, H.; Nishida, Y.; Ogura, Y. (Dai-Ichi Kogyo Seiyaku, Company, Ltd., Kyoto, Japan). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

A highly-loaded CWS requires addition of a dispersant which prevents powdered coal from aggregation. The authors started developing dispersants for CWS in 1980 and succeeded in creating Highcoal F-3225 which has much better effects on CWS than its predecessors. Electric Power Development Co., Ltd., has conducted CWS production tests using a pilot scale production plant (with a capacity of 1.5 t/h). This paper reports in detail characteristics of several types of CWS which were produced with addition of Highcoal F-3225, a nonionic dispersant, by a pilot scale production plant. 10 figures, 2 tables.

10840 (CONF-850530—, pp 951-956) **Fluid Carbon fuel production and utilization in Sweden.** Stigsson, L.L. (Fluid Carbon International AB, Malmoe, Sweden). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Fluid carbon International AB, a Swedish research company, has developed an integrated system for utilizing coal in the form of a concentrated aqueous suspension. The fuel consists of 65-75% solids, about 1% chemical additives and balance water. In 1982 a number of large Swedish and American corporations formed Svenska Fluid carbon AB to exploit the technology in Scandinavia. The first major plant for production of the fuel was erected and started up in 1984. The capacity is 250,000 MTPY equivalent to about 125,000 MTPY heavy fuel oil. Most of the fuel produced so far has been fired in a medium size steam generating boiler in Lund, south of Sweden. Several other commercial conversion projects from oil to Fluid carbon fuel are underway including a large utility burner demonstration project at the Sydkraft Power Plant in Malmoe.

10841 (CONF-850530—, pp 957-962) **Commercial slurry fuel developments at COMCO.** Beshore, D.G. (COMCO, St. Petersburg, FL). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

COMCO is entering its fourth year of full-time (three shift) commercial slurry fuel production with coal and petroleum coke based products. With recent short-term stabilization of oil prices, the economic and financial requirements of alternative fuels have resulted in COMCO seeking additional new and diversified fuel markets. Slurry fuel milestones during the 1984-1985 period include: (1) COMCO's supply of over 1.8 million barrels of coal-oil mixture (COM) for Florida Power Corporations's Bartow Unit No.1, (2) the first repetitive commercial scale bunkering of petroleum coke-oil mixture for a US Flag marine vessel (7000 shaft horsepower);

and (3) the start-up of two phosphate dryers on COM for an industrial customer. Technical and economic issues related to user acceptance of slurry fuels are presented along with COMCO's existing and future capabilities.

10842 (CONF-850530—, pp 963-972) **Flexible approach to expanding production capacity for Nycol.** Taernfors, E. (Nycol AB, Stora Vika, Sweden). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Nycol AB is a Swedish company that produces clean coal as well as coal water fuels. Production of these fuels was started in 1982 in an old cement plant. When capacity had to be increased, a cooperative agreement was reached with an existing cement plant to use some of their facilities. Investment in new storage and terminal facilities was shared. This paper discusses the pulverized coal and coal water fuels and the forecasted output capacity increase. 3 references, 10 figures, 6 tables.

10843 (CONF-850530—, pp 973-989) **CoaLiquid, Inc. coal slurry fuels commercial program - 1985.** Hawkins, G.T. (CoaLiquid, Inc., Louisville, KY). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

CoaLiquid Inc., a subsidiary of the McDonnell Douglas Corporation, has been in the coal slurry fuels business since 1976. As one of the longest standing commercial participants in this field, CoaLiquid has continued in its efforts to provide a total slurry fuel system to its customers. In 1985, CoaLiquid and its affiliates will operate coal-liquid mixing plants in Florida, Kentucky, Israel and the Republic of Korea. Fuel from each of these facilities is being distributed commercially. This paper reviews the design philosophy behind each of the plants, the specific retrofits performed in customer combustion units, and typical fuel specifications. Also discussed is the continuing fuels development work being performed in the new CoaLiquid coal slurry characterization laboratory. This facility is one of the best equipped in this field. Finally, the paper examines the economics of various slurry fuels from a user's perspective and offers forecasts for trends in slurry fuel pricing in view of recent changes in the prices of oil, coal and natural gas. 12 figures, 2 tables.

10844 (CONF-850530—, pp 992-1000) **Production of coal-water slurry fuel with low-ash western bituminous coal.** Sepulveda, J.L.; Yap, R.F.; Rothfeld, L.B. (Anaconda Minerals Co., Tucson, AZ). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Production of coal-water slurry (CWS) fuel using eastern coals with ash content between 5 and 12 percent has been widely reported. This paper describes the most important findings of an experimental program aimed at the development of a CWS formulation for low-sulfur western bituminous coals. Laboratory formulations were prepared using run-of-mine coal and coal cleaned either in a heavy media cyclone circuit or with organic liquids. For pilot plant testing of the best slurry formulation, coal was cleaned in the heavy media circuit. Two Anaconda coals, from West Elk mine in Colorado and the Beaver Creek mines in Utah, were tested for their amenability for CWS production. Several coal-water slurries of 67-70 percent solids by weight were produced. The CWS formulation developed for these western coals was sensitive to coal particle size distribution and dispersant type and dosage. Both of these parameters had a direct effect on the fluidity of the CWS obtained. The quality of the CWS was also dependent upon the content and nature of the ash, which had an effect on dispersant requirements and stability. Subtle changes in characteristics of coal samples mined at different times also affected slurry quality and required an adjustment to the formulation. 4 references, 2 figures, 4 tables.

10845 (CONF-850530—, pp 1001-1010) **Cape Breton Development Corporation's CARBOGEL coal water fuel project.** Landry, G.; Kazmel, R.; White, A.; Campbell, J.C.; Nicholson, R. (Cape Breton Development Corp., Sydney, Nova Scotia). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The Cape Breton Development Corporation has been very active as a CWF supplier. Using the CARBOGEL technology, it has produced over 6000 tonnes of CWF in its 4 tph continuous production pilot plant. CBDC's role has been a pioneering one, as the fuel producer for the largest test of its kind in the world (the 6000-tonne test at Chatham, N.B. for the combustion of CWF in utility boilers). The test took place over a period of 15 months and presented all the challenges of production, handling, transportation and combustion. The 6000-tonne test, and the many others for which CBDC-CARBOGEL CWF was used, proved the process and the fuel to be a technical success. The design process, using many common mineral processing techniques is very operable and extremely efficient. The process and the tests are briefly described. Specification CBDC-CARBOGEL CWF exhibits excellent slurry properties in the areas of rheology, handling and combustion. The continuation of the project at the pilot scale, with more emphasis on the economics, is guaranteed by an approved 15,000 tonne test in Charlottetown, P.E.I. This, and other demonstration projects being investigated, will certainly lead to commercialization of the process. 4 references, 5 figures, 2 tables.

10846 (CONF-850530—, pp 1011-1013) **Use of intensive mixing in the preparation of CWS.** Wickardt, U.J. (Eirich Machines Ltd., Maple, Ontario). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Normally coal water slurries require up to 10 hours of mixing in tanks equipped with agitators to fully homogenize the particle distribution and disperse the additives. An intensive mixer is described which can completely homogenize slurries in 3 to 10 minutes, depending on the coal and method of slurry preparation. Mixers are available for batch operation (up to 10,000 liters) and for continuous operation (240 tph). 2 figures.

10847 (CONF-850530—, pp 1019-1031) **Energy efficiency comparison of coal slurry transportation systems.** Nagata, K.I.; Yano, T.; Nagamori, S.; Yamada, T. (Mitsui Engineering and Shipbuilding Co., Ichihara-city, Japan). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Energy efficiency of total systems, from a coal preparation plant at mine sites through pipelines to a combustion system, for conventional fine coal slurry, coal slurry with improved dewatering properties, and highly loaded coal water mixture (CWM) for which dewatering is not required, is evaluated and compared with each other. The energy efficiency E in this paper is defined by the energy potential of coal H (Kcal/kg), energy consumption h (Kcal/kg) for operation of pumps and dewatering machines, etc., constituting the system, and the transformation efficiency e from the calorific value to electric power, as follows: $E = 1 - (h/e)/H$. Pipeline tests were conducted both for coal slurry with improved dewatering properties and CWM at Mitsui Engineering and Shipbuilding Company, and E was computed from the data obtained. It was shown from the results of evaluation and comparison that the merit and demerit of each system are quantitatively compared with each other with the introduction of the energy efficiency and the optimum system can be selected according to the transportation distance. The system aimed at the improved dewatering properties at coal preparation plants and pipeline terminals is proposed based on the results of the above mentioned evaluation. 6 references, 7 figures, 3 tables.

10848 (CONF-850530—, pp 1032-1046) **Delivering coal without the dust and noise.** Weiss, L.H.; Cartner, J.A. (Energy Technology Associates, New York, NY). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The Navy will reconvert one boiler to coal firing at the Great Lakes Naval Base, located on the shore of Lake Michigan about 40 miles north of Chicago. The transportation of coal to the Base and its delivery from the reception point to the boiler was studied. Coal and coal-water slurry can be delivered directly by rail to the proposed receiving/storage area about one mile from the boiler house. Coal-water slurry can also be delivered by barge or lake tanker to a single-point mooring buoy, offshore of the Base, to supply the day storage and main storage tanks through a pipeline system. This paper presents the results of the analysis of these alternate methods for transporting coal and coal-water slurry to the Camp Moffett receiving area and from there to the boilers. The existing site and equipment are described, then the environmental and aesthetic constraints, as well as the potential interference with the normal activities at the base are considered along with the costs for the most promising alternatives. 2 references, 5 figures, 6 tables.

10849 (CONF-850530—, pp 1047-1056) **Coal water slurry barge delivery to Boston Edison Mystic 4 for a demonstration test burn.** Faulkner, A.R.; Schmid, M.R.; O'Connor, H.W. (Bechtel Power Corp., Gaithersburg, MD). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The paper discusses the manufacture, shipment by barge, and usage of 2100 bbls of very low ash (2.8%) coal slurry. The demonstration firing was in the 135 MW Boston Edison Mystic 4 Unit. Two of 24 oil guns were replaced with Coen Company 2MV-CWS atomizers, rated at 35 MM Btu/HR each, in this Combustion Engineering steam generator with tilting tangential burners. This test is part of an investigation into what is involved in converting to coal water slurry (CWS) firing. As only a small percentage of the total heat input came from CWS, the effect on boiler performance is probably best determined by other means. The test did give good hands on experience handling the fuel inside and outside a utility sized boiler with barge delivery. 9 figures, 2 tables.

10850 (CONF-850530—, pp 1072-1080) **Western Resource Transport project: a liquid carbon dioxide/coal slurry pipeline.** Fite, W.E.; Johnson, B. (Department of the Interior, Denver, CO). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Western Resource Transport (WESTRANS) is an opportunity to increase western coal production through what may become the most important coal transportation system in the Nation. The WESTRANS pipeline will link the vast coal fields of Wyoming with the Pacific Coast, opening up the largest single energy reserve in the United States. WESTRANS will use the technology of liquid carbon dioxide slurry transport to carry coal approximately 1180 miles from the Powder River Basin to the Port of Long Beach for export to Pacific Rim nations. The pipeline's initial capacity will be 10 million tons of coal per year (MMTPY) in 1990, with an increased capacity of 15 MMTPY in 1995. This project could provide Powder River Basin coal FOB Long Beach tanker at $30 per ton, which equates to $1.44 per million Btu's. The demonstration of technology, the advantages of the project, schedules and project management are discussed. 4 figures.

10851 (DOE/ET/17086—1932, pp 1.1-1.23) **Preparation, handling, and storage.** Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

The nineteen participants in the Preparation, Handling, and Storage Workshop included six representatives from government research facilities, six representatives from private sector research, engineering, or vendor firms, three from the utility industry (including EPRI), and four from academia. The background statements which had been prepared on the agenda topics were used as a starting point for the discussion. Table 1-1 lists the agenda topics, indicates the prepared presentations that were given, and shows the priority rankings assigned to the proposed research topics by the group.

10852 (DOE/ET/17086—1932, pp 1.25-1.33) **Conventional coal cleaning of high-ash low-rank coals.** Ruby, J.D. (Bechtel Group Inc., San Francisco, CA). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

This paper briefly examines coal cleaning for Low-Rank-Coals (LRC). The level and method of physical cleaning is determined by specific site, coal and market conditions. However, the often low ash (and sulfur) contents and the relatively low value of LRC make general use of coal cleaning very unlikely. Additionally, current federal regulations - New Source Standards for Electric Utility Steam Generating Units - remove much of the incentive with regard to sulfur reduction because most plants will require flue gas desulfurization even after coal cleaning. Cleaning to reduce ash content may prove cost effective if it is combined with moisture reduction and if resulting transportation savings are significant. Reduced power plant ash handling costs alone will only justify very minimal cleaning, and other benefits are difficult to quantify because of the lack of comparative operating experience. 5 refs., 2 figs.

10853 (DOE/ET/17086—1932, pp 1.35-1.45) **Design, cost and economic benefits of ion exchange process to remove sodium from lignite.** Paulson, L.E.; Baria, D.N.; Kube, W.R. (Grand Forks Energy Technology Center, ND). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

Lignite mined in Northern Great Plains is used chiefly in generation of electricity. A major problem in powerplant operation is ash deposition on the fireside tube surfaces which limits the duration of high load operation. Studies have shown that this fouling is related to the lignite's sodium content. For a pc-fired boiler, the tolerable level of Na_2O content in the ash has been established to be 5%. Powerplants burning such lignite still require periodic on-line tube cleaning, but the deposits are soft and easily removed. Data from exploratory core drilling and from mine samples indicate that reserves of lignite with ash containing less than 5% Na_2O are limited. The sodium level of the produced lignite can be controlled in some mines by blending high- and low-sodium lignite from different locations within active mine pits. As resources of low sodium lignite are diminished, the average sodium content of lignite will rise and ash deposition problems in combustion will increase. Design modifications used in pc-fired units to reduce the problems of ash deposition include providing larger furnace volumes to give lower gas temperatures; wider tube spacing; and sufficient wall and boiler tube on-line cleaning auxiliaries to remove deposits. The possibility of using an additive with the fuel has been extensively evaluated, but no material added at the furnace which effectively reduces the problem has been found in pilot plant or commercial operation. The method reported in this paper is to remove sodium before combustion by ion exchange. Process description, cost and estimated benefits are included. 11 refs., 2 figs., 6 tabs.

10854 (DOE/MC/20122—2) **Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, January-March 1985.** Looney, J.H.; Im, C.J. (UCC Research Corp., Bristol, VA (USA)). Apr 1985. Contract AC21-83MC20122. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85012880.

In the second quarter of project performance, three additional seam coals were analyzed for cleanability. The possible yields, ash, and sulfur at 1.32 specific gravity separation of the coals were: (1) 88%, 2.4%, and 0.49% for Alma Seam; (2) 93%, 0.9%, and 0.70% for Elkhorn No. 2 Seam; and (3) 93%, 1.5%, and 0.61% for Elkhorn No. Seam. Ultimate, ash composition, and ash fusion analyses were also completed for all the clean coals obtained from each of the different sources. The parametric laboratory testing for column flotation conditions was initiated with Elkhorn No. 3 Seam coal. The testing indicates that a product ash of 0.70 - 0.75% is possible with an associated yield of over 80% using first-stage product (1.40% ash) ground to 50 mesh x 0 size consist. With regard to the product yield, 5.0 about 10.0% feed solids, near neutral pH, and

pulp feed rate of 500 about 600 ml./min. represent the optimum conditions. Although a distinct trend was noticed between product yield and the parameters studied, product quality remains fairly constant for all the tests. 6 figs., 6 tabs.

10855 **(DOE/MC/20122—4) Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, July-September 1985.** Looney, J.H.; Im, C.J. (UCC Research Corp., Bristol, VA (USA)). Oct 1985. Contract AC21-83MC20122. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004815.

The systematic investigation into the effects of coal-water slurry dispersants was continued during this reporting period. Two related variables, product viscosity and zeta potential, were evaluated using a pH range of approximately 6.0 to 10.0, employing three different concentrations of anionic, Ammonium naphthalene sulfonate. Solids loading and grind size were held constant at 60.0% and 44 microns, respectively. The range of results as pH was increased is as follows: (1) 0.50% dispersant: 369 to 82 cps viscosity, -26.0 to -70.7 mV zeta potential; (2) 0.75% dispersant: 81 to 42 cps viscosity, -26.4 to -69.7 mV zeta potential; (3) 1.00% dispersant: 110 to 84 cps viscosity, -23.2 to -65.6 mV zeta potential. The best overall viscosity performance appeared to be with 0.75% dispersant concentration. The zeta potential study seemed to acknowledge this conclusion. Secondly, the effect of varying coal solids loading upon product viscosity was evaluated. Product solids was varied from roughly 50.0 to 65.0%, with dispersnat concentration, guar gum stabilizer concentration, and product pH held constant at 0.75%, 0.05%, and 8.0%, respectively. Three particle top sizes (75, 44, and 20 microns) were studied. The range of viscosity results as solids loading was increased as follows: (1) 75 microns top size: 177 to 400 cps; (2) 44 microns top size: 93 to 292 cps; and (3) 20 microns top size: 40 - (non-flowable paste). At 60.0% coal solids loading, the best overall performance with regard to grinding and product viscosity appeared to be the 44 micron top size material (145 cps). Lastly, three different stabilizers were evaluated at 0.05% concentration to determine product storage capability. Holding solids loading, dispersant concentration, product pH, and product top size constant at 60.0%, 0.75%, 8.0, and 44 microns, respectively, for each of the three stabilizers, guar gum gave the best performance. 3 figs., 4 tabs.

10856 **(DOE/PC/70776—T5) Characterization of coal surfaces. Technical progress report, August 21-November 20, 1985.** Fuerstenau, D.W. (California Univ., Berkeley (USA). Coll. of Engineering). Dec 1985. Contract FG22-84PC70776. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004272.

The overall objective of this research program is to investigate the surface character of fine coal particles with a view towards delineating how surface or interfacial properties of coal influence coal behavior under various beneficiation and utilization environments. The previous quarterly report summarized the film flotation technique developed in our laboratories and its use in generating surface-based partition curves. The mean wetting surface tension parameter, γ/sub LC/, was correlated with the chain length of the alcohol used for lowering the surface tension of alcohol-water mixtures. Flotation response was interpreted in terms of the various surface tension parameters that can be obtained from our partition curves. During this past quarter, the film flotation technique was studied further to affirm its effectiveness as a coal characterization tool. During the present quarter film flotation partition curves were obtained to determine how the mineral matter content of a series of bituminous coals affects the wettability of the coal. The flotation response of the coal samples was also determined and the optimum flotation correlated with the mean wetting surface tension of the coals. Detailed study of the oxidation and wettability/flotability of one coal sample was carried out. Preliminary experiments of the heat of displacement (adsorption) of short-chained alcohols on bituminous coal were undertaken. Considerable effort was devoted to analysis of the film flotation process in terms of an energy balance model, but the results will not be presented until the next report. 6 figs., 1 tab.

10857 **(DOE/PC/81205—T1) Advanced physical fine coal cleaning microbubble flotation. Topical report No. 1. GHH-Bergbau Forschung microbubble coal flotation machine.** Gagnon, A.; Chari, M.V. (Bechtel National, Inc., San Francisco, CA (USA)). 12 Dec 1985. Contract AC22-85PC81205. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004157.

In conventional coal flotation, it is usual to use mechanically agitated cells. The agitator generates the air bubbles, mixes the slurry and air bubbles to bring about "bubble-particle" collisions. The average bubble size ranges between 500 and 1000 micrometers in diameter. Conventional flotation suffers from the following disadvantages: poor recovery with fine particles below 140 mesh due to inadequate bubble-particle encounter, or poor collision efficiency; comtamination of concentrates due to physical entrapment of ash particles in the froth; and loss of yield due to coal dropping off from the bubbles due to the agitated environment in the cell. The GHH-Bergbau Forschung (GHH-BF) microbubble flotation unit addresses the above noted drawbacks of conventional flotation and more effecitvely than other microbubble flotation systems. The innovations introduced by the GHH-BF unit in coal flotation, which are particularly relevant to the production of ultra clean coal, are briefly discussed. 1 ref., 1 fig.

10858 **(DOE/PC/81504—T2) Pneumatic transport of coal in a variable inclined test loop. Quarterly report 2.** Rohatgi, N.D.; Klinzing, G.E. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Dec 1985. Contract FG22-85PC81504. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004273.

Despite many frequent references, in the literature on pneumatic transport, to the advisability of employing diagonals rather than vertical runs, research and development in the area of inclined flow are very limited. Another unexplored area in pneumatic transport is the cocurrent downflows of solids and gas, either in vertical or inclined pipes. Flow tests with Virginia Coal were conducted in the Variable Inclined Test Loop, to provide a data base for the evaluation of cocurrent upflow and downflow of solid-gas mixtures in inclined pipelines. Preliminary results indicated that: (a) the classic minimum pressure-drop with gas velocity was present for vertical flow (0=90°) and for flow at inclination of 60°; (b) most of the data, for vertical, horizontal and inclined flows appeared in the region of decreased voidage, where dense flow could be expected; (c) a maximum in slip velocity was present with increasing values of (1-voidage); and (d) the effect of solid flow rates (on pressure-drop curve; Matsen diagrams, and slip velosity) was more marked for vertical flow than for inclined or horizontal flows. 9 figs., 1 tab.

10859 **(DOE/PETC/TR—86/2) Annotated bibliography of US government coal preparation publications, 1910-1984.** Killmeyer, R.P.; Hucko, R.E.; Deurbrouck, A.W. (USDOE Pittsburgh Energy Technology Center, PA). Dec 1984. 124p. NTIS, PC A06/MF A01; GPO Dep. File Number DE86004896.

This publication is an annotated bibliography of all coal preparation work conducted or funded as part of the Federal coal preparation program, which was administered by the Department of Interior's USBM until 1977, when that function was transferred to the newly created Department of Energy. It includes reports of work conducted by in-house government personnel, as well as final reports by outside contractors funded by the coal preparation program. (Most work and reports were of an in-house nature until the early 1970's.) It is organized and numbered chronologically. Each reference includes the title, the authors, the type of publication, the date (year), the number of pages, and a brief abstract. There is a subject index in the back that directs the user to the relevant references. This publication was conceived as a formal expansion and updating of A.W. Deurbrouck's USBM IC 8059 entitled "Bureau of Mines Publications on Coal Preparation, 1910-1960," written in 1961. It was expanded by adding all papers, journal articles, book chapters, etc., written and published by government personnel involved in coal preparation research, and all final reports from contractors receiving federal coal preparation funding. The above publication was originally limited to only USBM publications (Reports of Investigation, Information Circulars, Bulletins). Also, the original

abstracts were expanded to provide more information about each reference. The publication was updated by adding references of all works from 1960 through 1984. Updated publication lists have been distributed by PETC's Coal Preparation Division over the last few years, but this publication is meant to supersede them because it is more inclusive, informative, and current. 373 refs.

10860 **(EPRI-CS—4383) Froth flotation for fine-coal cleaning. Final report.** Olson, T.J. (WEMCO, Sacramento, CA (USA)). Dec 1985. 92p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI86920125.

Froth flotation of fine coal was investigated with the objectives of improving flotation at existing coal-cleaning plants and providing design guidance for future plants. Using hydrodynamically scaled-down laboratory and pilot flotation cells, and the Klimpel flotation model, a methodology was developed to relate laboratory-scale flotation results to full-scale flotation circuits. Froth Factor, the percent of froth over the froth lip, was determined to be the key element of this scale-up methodology. Results showed that simple, inexpensive changes in flotation parameters such as air rate and reagent dosages can significantly improve full-scale flotation product recovery and grade, and that more complex flotation circuitry can produce better recovery levels of high-grade coal than more commonly used rougher-only flotation circuits. In particular, cleaning rougher product can effectively reduce pyritic sulfur content. Results also demonstrated interaction between different size fractions of coal. Flotation rates were shown to depend on feed size consist, and it was found that separations based on differences in flotation rates are more advantageously performed on fine topsizes. Ultimate recoveries appear unaffected by size consist. 6 refs.

0140 Combustion

REFER ALSO TO CITATION(S) 10769, 10794, 10807, 10813, 10827, 10831, 10833, 10834, 10845, 10849, 10851, 11212, 11213, 11734

10861 (CONF-850530—, pp 283-303) **Evaluation of anthracite coal water slurries.** Borden, M.; Klett, M.G.; Cutting, J.C. (Gilbert/Commonwealth, Inc., Reading, PA). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

A study to evaluate the potential of anthracite as a coal water slurry boiler fuel was conducted for the Pittsburgh Energy Technology Center of the US Department of Energy. The study had two objectives: fundamental slurry formulation experiments leading to the production and combustion testing of suitable anthracite slurries, and analytical evaluations of the potential of anthracite slurry as a boiler fuel for new industrial and utility boiler application and for retrofit application of an industrial oil fired boiler. It was found that anthracite can be readily processed into a coal water slurry fuel and fired with a stable flame and high carbon conversion in an industrial oil designed boiler. The analytical application studies have shown that under certain conditions anthracite water slurry can be competitive with No. 6 oil and bituminous coal fired boilers. This paper reviews the anthracite slurry program developed under the contract to PETC and the results of the anthracite slurry experimental and analytical evaluations. 7 references, 6 figures, 15 tables.

10862 (CONF-850530—, pp 343-356) **Achieving high combustion efficiency burning coal-water fuels.** Pohl, J.H.; Sepulveda, J.; Rothfeld, L.B. (Energy and Environmental Research Corp., Irvine, CA). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Converting oil- or gas-designed boilers to fire coal-water-fuels (CWF's) may require that the boiler be derated. Limitations in boiler performance can be dealt with by selecting coals, cleaning mineral matter from the coals, and to a lesser extent by grinding the coals finer. Problems of burnout are being addressed by attempts to reduce the atomized droplet size. Previous trials of CWF's combustion have resulted in burnouts ranging from 60-99.9%. The results of previous combustion tests are shown in a table. The reduced burnout of CWF's compared to coals has been attributed to agglomeration of the coal particles within droplets; reduced residence time caused by droplet ballistics; and time required to evaporate the slurry water. Studies suggest that high burnouts of CWF's can be achieved with CWF's manufactured from reactive western coals without the use of fine atomization, high preheat, or increased heat release rates. Use of CWF's manufactured from western coals will have reduced mass loading compared to CWF's manufactured from higher rank eastern coals. The effect of additional water on flame stability, flame temperature, radiant heat flux and furnace efficiency must be considered for each specific boiler. This paper reports results of pilot scale trials burning CWF's manufactured from a high reactivity western coal and scaling of these results to predict performance of an operating oil- and gas-fired utility boiler. 27 references, 6 figures, 4 tables.

10863 (CONF-850530—, pp 357-376) **Correlation of the spray characteristics of coal-water-fuels.** Pohl, J.H.; Sepulveda, J.; Rothfeld, L.B. (Energy and Environmental Research Corp., Irvine, CA). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Combustion trials indicate that one way to successfully use Coal-Water-Fuels (CWF's) is to improve atomization. Finer atomization of CWF's will improve flame stability, turndown, and burnout. Prediction of atomization behavior of CWF's will require correlation between physical properties of the CWF's and the mass median droplet size and a relation between the mass median droplet size and the droplet size distribution. Significant problems exist in correlating physical properties of CWF with atomizer performance. First, the fluid is two phase and does not behave as a single simple fluid. The viscosity at CWFs is non-Newtonian but may be dilatant or pseudoplastic depending on the CWF. Second, viscosities are rarely measured at shear rates which approach those achieved in atomizers, 1000-10,000 1/sec. Finally, measurement of the particle size distributions is uncertain because of limits of the measuring technique or the ability to interpret the results. This paper reports the correlation of viscosity and fuel to air ratio for a series of CWF atomized in a single-hole Y jet. The CWF were produced by the same process from the same coal. The coal particle size and mass loading of the CWF were varied. The resulting correlation is then compared, to the extent possible, with information in the literature on different CWF atomized with other nozzles. 14 references, 13 figures, 2 tables.

10864 (CONF-850530—, pp 377-391) **Droplet size distribution changes during the atomization of a coal water slurry.** Hedley, A.B.; Yiu, S.M. (Sheffield Univ., England). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The fact that the coal in the water is very finely ground does not necessarily mean that each particle will burn as an individual particle of pulverized coal after atomization, since agglomeration and carbonization of multi-particle assemblies may occur within the flame. The resultant burning time of the coal particles may therefore be much greater than the size distribution of the parent coal would suggest leading to possible slagging or carbon loss problems in practice. This paper reports the work on a commercial coal-water slurry containing 70% coal and 30% water, atomized by compressed air in a twin-fluid atomizer of the external mixing type with a convergent annular air nozzle. The size distribution, concentration and surface area of the droplets were measured by an in-situ particle sizer which operated on the principle of laser diffraction. The breakup characteristics of CWS were studied. Detailed structure of the spray was obtained by applying tomographic transformation. The variation of the spray with atomizing air and CWS flow rates were investigated. 5 references, 10 figures, 2 tables.

10865 (CONF-850530—, pp 392-401) **Atomization of coal water mixtures.** Allen, J.W.; Rennie, A.G.; Welbourne, M.C. (NEI International Combustion Ltd., Derby, England). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The provision of an isothermal test rig dedicated to coal water mixture (CWM) work has enabled significant progress to be made in the development of atomizers for CWM burner systems. When CWM atomizer design was first contemplated, problems were presented by the high viscosity of the material, coupled with the absence of a simple means of viscosity reduction prior to atomization, as is available for the heavy fuel oils. Some success had been obtained with modified external mix steam assisted pressure jet atomizers with coal oil mixtures. Our first attempts at CWM atomization to enable small scale combustion trials up to 0.5 tons/hr CWM to proceed, were based on scaled down versions of this steam assisted pressure jet design. These were unsuccessful, producing poor atomization of the CWM. Another small scale atomizer was developed which eliminated the use of small diameter orifices or narrow slots in the atomizer components carrying the CWM and effected some viscosity reduction prior to final atomization. One key feature of CWM atomizer design may be to achieve as wide a spray angle as possible in order to maximize the residence time for preheating and combustion initiation. This paper describes the equipment and techniques available to study atomization characteristics of CWM and the application of these techniques to particular CWM atomizer designs. 2 references, 8 figures.

10866 (CONF-850530—, pp 402-429) **Photographic and Malvern analysis of coal-water slurry atomization.** Meyer, P.L.; Chigier, N. (Carnegie-Mellon Univ., Pittsburgh, PA). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Photographic and laser diffraction techniques were used to characterize 70 wt% coal-water slurry sprays and water sprays produced by a commercially-sized, external mix atomizer (600 lb/hr fuel flow rate). Malvern measurements of spray size distributions were made within the first ten inches of the atomizer exit. Compared to the obscuration levels in slurry sprays (0.2 to 0.4), water sprays were optically very dense (obscurations of 0.75 to 0.96), which reflects the higher droplet number density of water sprays. The Sauter or mass mean diameter of both slurry and water sprays increases with increasing downstream distance and slurry spray mean diameters are about 1.3 times greater than those for water. The slurry mass mean diameters measured in the first ten inches of spray (from 52 to 66 μm) are about 2 to 4 times the mass mean diameter of the pulverized coal constituting the slurry. Radial traverses of the sprays are similar in shape for both liquids. There is a broader size distribution of small particles near the center of the sprays and a narrower distribution of large particles at the edges. In order to have a common basis for comparison, obscuration levels should be reported along with size distributions. The measurement position in the spray must also be reported. We show that moving just eight inches along the atomizer center line doubles the measured SMD and MMD of water sprays. Finally, the size limits of the Malvern must be recognized. Other methods must be used to check for the presence of oversized drops which could cause reduced combustion efficiencies. 11 references, 18 figures, 3 tables.

10867 (CONF-850530—, pp 430-439) **Effect of fuel formulation on the atomization characteristics of coal-water mixtures.** Winters, P.J.; Bailey, R.T.; Olen, K.R. (Babcock & Wilcox Co., Alliance, OH). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

In a properly structured flame the combustion or carbon conversion efficiency of coal-water fuels (CWF) has been shown to be directly dependent on the quality of the atomized fuel spray. In evaluating CWFs produced by various candidate suppliers, it is important, therefore to properly assess relative atomization characteristics. As part of a Florida Power and Light (FPL) program to evaluate CWF as a possible alternate for heavy oil, Babcock and Wilcox was contracted to determine the atomization characteristics of five chemically stabilized CWFs produced by four different suppliers. To provide a baseline for comparison, a moderately loaded, additive-free sixth fuel was included in the test program. All of the CWFs were produced from the same high-rank bituminous coal and were certified to be representative of commercial products. Atomization tests were conducted using as an atomizing media and a modified T-jet multi-orifice atomizer that had a nominal rating of 6 x 10^6 Btu/hr. The fuels were preheated in-line to 100 F just prior to atomization. Malvern laser optics were used to quantify spray quality, which was determined over a range of input conditions. Fuel flow rates were varied from 300 to 600 lbs/hr, and the mass of atomizing air to fuel flow ratio ranged from 0.125 to 0.60 lb of air/lb of fuel. Atomized fuel spray qualities, as defined by mass mean droplet diameter and droplet fraction greater than 169 microns, are compared for the different fuels. The relationship between spray quality and atomizing air requirements per million Btu heat input are presented in graphical form. Testing, analytical procedures, and the significance of the results are discussed in detail. 5 references, 6 figures, 1 table.

10868 (CONF-850530—, pp 443-462) **Scale-up of coal water fuels experiments in pilot furnaces for evaluation of utility boiler performance.** Richter, W.; Pohl, J.H. (Energy and Environmental Research Corp., Irvine, CA). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

This paper combines pilot scale testing of Coal-Water Fuels (CWFs) with engineering analysis to predict the profiles of burnout, temperature and heat flux as well as furnace and boiler efficiency for combustion of individual slurries in specific utility boilers. Tests and analysis of performance are reported for slurries manufactured from four coals. The slurries were prepared by three different slurry manufacturers. Two of the slurries were tested at different particle size distributions of the same coal. The evaluation technique is demonstrated in detail for one western and one eastern coal slurry. The pilot scale combustion trials were conducted in two nominal 1 x 10^6 Btu/hr combustors which simulated many features of utility boilers. Results from these furnaces were analyzed using a sophisticated two-dimensional furnace performance analysis procedure. The reactivity of the coal was adjusted in the engineering analysis procedure to achieve agreement with experimental data. The values which resulted in best agreement with the measurements from the pilot scale studies were then used in an analogous three-dimensional furnace model to estimate the performance of the CWFs in an existing tangentially gas- and oil-fired 135 MW(e) utility boiler. Combustion efficiencies of the various slurries predicted for this boiler varied between 92.4 and 99.9%. Characteristics of the individual slurries are shown to have considerable impact on the predicted furnace and boiler efficiencies. 8 references, 20 figures, 6 tables.

10869 (CONF-850530—, pp 463-478) **Analysis on droplet burning histories of different coal liquid mixtures.** Gao, J.; Huang, Z.X.; Yao, Y.Q. (Institute of Engineering Thermophysics, Beijing, China). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Experimental investigations and theoretical analysis on combustion performances for CWM, COM, CMM, CAM and CWMM (coal water mixtures, coal oil mixtures, coal methanol mixtures, coal alcohol mixtures, and coal water methanol mixtures), with different coal densities compared with pure oil and coal powder have been carried out by the present authors. Combustion experiments in a precision thermobalance and a high temperature gas experimental device indicate: the lowest ignition ambient temperature for each kind of coal liquid mixture droplet at which bright flame can be observed is between 610-700°C for CWM, CMM, CAM and COM. Below this temperature, the volatile within the coal slurry droplet would not fire. Higher ambient temperature increases the highest temperature of coal slurry droplet burning, and reduces the time of droplet burning. Photo pictures and laser interferometer pictures show the history of coal slurry droplet burning. 6 references, 20 figures, 1 table.

10870 (CONF-850530—, pp 481-496) **Comparative combustion studies of ultrafine coal/water slurries and pulverized coal.** Holve, D.J.; Gomi, K.; Fletcher, T.H. (Sandia National Labs., Livermore, CA). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The effects of slurried and pulverized fuel physical properties (specifically particle size, density, and phase composition) on combustion are described in this paper. For solid fuels there is considerable flexibility for controlling the particle size, which in turn has a significant impact on ignition, char burnout, and emissions. In contrast, the chemical properties and reaction temperature range of a given fuel are narrowly constrained in most applications. In this work a laminar flow reactor is used to study the initial stages of combustion of coal/water slurries and pulverized coal. In conjunction with the flow reactor, a laser-based in situ particle counter has been used to determine the size distributions of pulverized coal and various slurry mixtures prior to and during combustion. Two numerical models are used in conjunction with the experimental results to provide a preliminary analysis of the effects of water content on evaporation and devolatilization, and also of the effects of particle swelling on char burnout times. The effects of fuel type on atomization, devolatilization, and subsequent char burnout are also described in the paper. Experimental results are discussed and interpretations of these results suggest that coal/water slurries will have significantly longer char burnout times than pulverized coal, and will exhibit markedly different ash deposition features due to the production of larger and fewer flyash particles. 15 references, 11 figures, 2 tables.

10871 (CONF-850530—, pp 497-503) **Agglomeration, evaporation and devolatilization of coal water mixture.** Mingjiang, N.; Zhenyu, H.; Xinyu, C.; Guoquan, H.; Yuanquan, C.; Kefa, C. (Zhejiang Univ., Hangzhou, China). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The Combustion Laboratory of Zhejiang University has been engaged in research work on combustion of coal water mixture (CWM) for five years. While doing laboratory scale and industrial scale applied research on flame combustion and fluidized bed combustion of CWM, we have also done some mechanical research on the burning process of a single CWM pellet (or droplet) to provide data for applied research. Some of the mechanical research has been reported in previous papers. Reported here is some further work. 17 references, 12 figures.

10872 (CONF-850530—, pp 508-518) **Combustion trials on coal water slurry and petroleum coke water slurry.** Mills, B.; Turner, S.J.; Grinzi, F.; Romani, G. (Peabody Holmes Ltd., Huddersfield, England). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Reocarb is a coal water slurry produced by an Italian firm which has a high coal concentration, relatively low viscosity, and high stability in storage. The firm signed a collaboration agreement with an English combustion engineering firm to develop combustion equipment suitable for commercial exploitation of the new fuel. This paper describes the general characteristics of Reocarb, its preparation, a combustion test rig, design of a burner tested, and associated handling equipment. A comparison is made of the combustion performance of pulverized coal, a coal water slurry, and a petroleum coke water slurry. 2 references, 2 figures, 2 tables.

10873 (CONF-850530—, pp 519-528) **Study on the ways of raising combustion efficiency and intensity of coal water slurry.** Kefa, C.; Xinyu, C.; Deshou, L.; Minghu, X. (Zhejiang Univ., China). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Coal water slurries (CWS) have successfully sustained stable ignition and combustion in both laboratory and industrial furnaces. But for commercialization, especially in oil-fired boilers, technical problems still need to be solved. The major problems are: decrease in boiler output of 30-50%; difficulty in retrofitting an ash hopper into oil furnaces; high heat losses due to unburned carbon in ash deposit; and need for air preheater for coal slurry combustion. This paper describes a vertical pre-combustor, use of special jets in the furnace, and combustion tests with air at ambient temperature. Results show that the pre-combustor intensifies ignition and combustion; the jets promise a considerable rise in combustion efficiency; and combustion of CWS in cold air is possible if appropriate measures are taken. 3 references, 4 figures, 3 tables.

10874 (CONF-850530—, pp 529-541) **Combustion characteristics of coal and pet-coke water mixtures.** Michele, G.D.; Graziadio, M.; Ligasacchi, S.; Belli, R. (ENEL-CRTN, Pisa, Italy). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

At the Nuclear and Thermal Research Center (CRTN) of ENEL, the Italian Electricity Generating Board, coal-water slurry combustion tests have been underway since 1982 to evaluate the combustion characteristics of this fuel. Most recently, experimental trials were performed using four types of coal slurries in an experimental 2 MW(t) burner. These slurries were obtained from three parent coals, with different particle size distribution and coal concentration. A stable bright flame was obtained with all the slurries without gas support using 200 C combustion air. The combustion efficiency ranged between 96 and 99%. Using the same burner, exploratory tests were carried out to evaluate the feasibility of firing a petroleum coke-water slurry. In this case, the mixture could not be fired satisfactorily without 5% gas support. Carbon conversion efficiencies between 83 and 88.5% were obtained under the operating conditions of coal-water slurry tests. The peculiar features of coal and pet-coke slurry fly ash were studied. Furthermore it was conjectured that the combustion mechanism of coal slurry fuels and petroleum coke-water mixtures would be different. 10 references, 9 figures, 4 tables.

10875 (CONF-850530—, pp 543-556) **Pilot-scale combustion tests of CWM for a modified water-tube package oil boiler at KIER.** Kang, S.K.; Shin, D.H.; Lee, J.K.; Kim, D.C. (Korea Institute of Energy and Resources). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Combustion tests of CWM fuel were performed in a water-tube package boiler (steam production capacity: 3 tons/hr), which was originally designed for oil-firing and was modified to burn coal-water mixture. Combustion efficiencies of 90-94% were obtained, and the maximum combustion efficiency was obtained at a boiler load of about 70%. NOx emissions ranged from 400 to 550 ppm, varying with the preheat temperature and swirl number of combustion air. A relatively constant level of about 120 ppm was obtained for CO emissions. The amount of ash deposited was approximately 11% of the total ash formed and the properties of ash varied in each section of the boiler. 4 references, 9 figures, 4 tables.

10876 (CONF-850530—, pp 579-589) **Modeling coal-water-mixture spray collective combustion.** Berry, G.F.; Choi, U.S.; Chiu, H.H. (Argonne National Lab., IL). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

One of the major problems with CWM combustion is the lack of understanding of the mechanisms of CWM ignition and combustion, partly because CWM combustion is a new concept and partly because CWM combustion is very complicated involving chemical reaction, turbulence, and heat/mass transfer in multiphase environment. The modeling of CWM combustion is based on the conventional single droplet theory. The major shortcoming in this conventional approach is that it fails to predict accurate combustion time because the single droplet theory assumes that each coal particle burns with its own flame regardless of the spacing between particles in a droplet. This assumption is not correct for practical combustors because as the CWM fuel with high solids loading is atomized, droplets containing many coal particles are formed. The objective of this paper is to present a new concept, named collective combustion of CWM sprays. In this paper, the background of this new concept and the difference between collective combustion and single droplet CWM combustion are described. A numerical assessment of the likelihood of the occurrence of the collective phenomena in CWM spray combustion is made. Current modeling approach, which is basically an extension of the group combustion theory in liquid sprays to CWM spray combustion, is described.

Major aspects of the modeling approach are highlighted; the future experiments that are needed to validate the model are outlined; and the significance of modeling the collective behavior in coal-water slurry sprays are shown. 2 references, 5 figures.

10877 (CONF-850530—, pp 596-605) **Comparison of the performance of a cross-section of commercial CWF burners.** LaFlesh, R.C.; Rini, M.J.; Lachowicz, Y.V.; Levasseur, A.A. (Combustion Engineering, Inc., Windsor, CT). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Combustion Engineering (C-E) has been conducting the comprehensive testing of four commercial scale (25 x 10^6 Btu/hr heat input) CWF burners as part of DOE's CWF Combustion Characterization program. A variety of basic burner types were selected in order to cover a range of utility boilers, industrial boiler, and process heater applications. Generic burner designs chosen represented tangential corner firing, high swirl wall firing, refractory chamber wall firing, and combined refractory/register wall firing concepts. Each burner was initially evaluated through a series of preliminary tests to identify potential design deficiencies which could be modified prior to detailed performance characterization. The preliminary tests included cold flow atomization testing, combination shakedown/optimization testing and an abbreviated performance characterization. The comprehensive testing during the final evaluations provided documentation of optimum burner operating parameters under conditions modeling commercial boiler furnaces. Performance comparisons can be drawn between generic designs, since a single uniform baseline CWF was utilized throughout the test series. All four burners have been subjected to preliminary testing; three have undergone detailed matrix testing. The test results indicate that some generic burner types are currently suitable for application to commercial scale CWF trials. The information presented in this paper represents the data that had been analyzed. 6 references, 12 figures, 3 tables.

10878 (CONF-850530—, pp 607-609) **Feasibility of wet oxidation for combustion of coal slurries.** Engleman, V.S. (Science Applications International Corp.). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Results from the literature on the wet oxidation of bituminous coal, lignite, and peat are reviewed. The information available at temperature >600°F is incomplete and inadequate for design equations. This study aims at obtaining the needed data. A bench-scale process development unit is being designed to operate at 5000 psig, 1000°F, at a nominal feed rate of 250,000 Btu/hr. A preliminary economic analysis is also given of the wet oxidation of coal. Initial experiments are planned for the summer of 1985. 11 references, 2 figures.

10879 (CONF-850530—, pp 612-628) **Fluidized bed combustion of coal-water slurry.** Rowley, D.R.; Lau, I.T.; Friedrich, F.D. (Babcock & Wilcox Co., Alliance, OH). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The fuels tested included two different slurries; beneficiated (70% solids) and unbeneficiated (60% solids) coal-water slurry. Stable combustion was attained for both fuels, and parametric testing was carried out to determine the effects of varying operating parameters on performance. Measured performance characteristics included combustion efficiency, emission of nitrogen oxides and carbon monoxide, and sulfur capture efficiency. The parametric tests resulted in correlations between performance and operating parameters that were generally in agreement with trends established through years of experience with fluidized-bed coal combustion. The effect of changing the fluidizing velocity, fluidized-bed temperature, calcium-to-sulfur feed ratio, and fly ash recycle rate is discussed in detail. The CWS feed system and method of injection are described. The results of this test program suggest that fluidized-bed combustion is not only a feasible method of combusting coal water slurry but that it may also offer potential advantages over combustion in a conventional burner. Optimum burner design and fine atomization, which are important to achieving good combustion in a conventional system, are not necessary in a fluidized bed. Slurry injection into the bed is relatively simple. Also, the fluidized-bed system can perform well with unbeneficiated slurry as well as beneficiated fuel. 4 references, 19 figures, 4 tables.

10880 (CONF-850530—, pp 631-639) **Combustion technology of coal water mixtures.** Kiga, T.; Saitoh, H.; Miyamae, S.; Takahashi, K.; Kataoka, T. (Ishikawajima-Harima Heavy Industries Co., Ltd., Tokyo, Japan). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Ishikawajima-Harima Heavy Industries Co., Ltd., or IHI has been developing various technologies related to CWM. In this presentation, CWM combustion technology of IHI is introduced. The combustion characteristics of CWM differ from those of pulverized coal in the mechanism of devolatilization combustion, combustion of char and NOx formation since CWM contains about 30% water. Various kinds of research work including laboratory tests, such as the measurement of the specific surface area and reaction rate of char have been performed to clarify the mechanism. In CWM, it is important to obtain fine atomization. Recommendable atomizer design was selected based on atomizing tests on various atomizers and it was confirmed that the greatest life span of atomizers is obtainable by attaching anti-wear sleeves to sites at which severe erosion may occur. Through the CWM combustion tests at IHI's combustion test facilities, combustion performances or NOx emission and unburnt carbon became predictable based on CWM and its parent coal properties. 2 references, 19 figures, 3 tables.

10881 (CONF-850530—, pp 642-650) **Experience with the NRC burner assembly.** Bennett, A.; Capes, C.E.; Jonasson, K.A.; Thayer, W.L.; Burrill, K.F.; Burnett, D.; Thambimuthu, K.V. (National Research Council of Canada, Ottawa, Ontario). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The National Research Council of Canada (NRC) embarked on a Coal Liquid Mixture (CLM) burner tip development program in 1981. The goal was to develop an erosion resistant nozzle capable of atomizing efficiently the viscous, abrasive coal-oil mixtures of the time. Subsequent development led to an adjustable wear resistant atomizer integrated into a complete combustion assembly which has served as a useful experimental tool in several studies. Adjustment of the combustion assembly can be effected for today's wide range of coal liquid fuels and combustion environments. The versatility of this apparatus is illustrated here for several combustion applications ranging from heavy oil firing with erosive additives to a rigorous coal-water combustion study in a flame tunnel. 9 references, 10 figures, 3 tables.

10882 (CONF-850530—, pp 655-661) **Combustion of coal water slurry in a gas turbine combustor.** Wang, Y.S.; Qi, Z.M.; Ma, R.X.; Gu, J.W.; Zhang, X.Q.; Gao, L.J.; Cao, J.; Zhang, C.M.; Xiao, G.Y. (Institute of Engineering Thermophysics, Beijing, China). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

A special gas turbine combustor test rig was designed for using coal water slurry as fuel. The combustor used in the test is an alternative of the aero-engine type. The atomizer and flame liner were modified during the testing. Three types of air-blast atomizers were designed for coal water slurry according to different concepts. After a long period of testing, the premixed type of the air-blast atomizer was recognized as the best one. The flame liner is coated by ceramic material. The ignition performance of the slurry can be improved by the use of the ceramic coating. The slurry used in test is made of Datong coal with 3% ash content. The coal/water ratio is about 52/48. The maximum size of the coal particle in slurry is 70μm. After a large amount of sifting work, a suitable additive was obtained. By using this additive, a slurry with viscosity of 464.4 cp is produced though the ash content is 3% and the coal particle size is below 70μm. A satisfactory ignition and combustion performance could be obtained provided the coal water

slurry was prepared under special conditions. Some modifications of the combustor have been done. 4 references, 4 figures, 6 tables.

10883 (CONF-850530—, pp 662-669) **Piston engine for coal-water slurry fuel.** Trucco, H.A. (General Applied Science Laboratories, Inc., Westbury, NY). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

A combustion process for burning coal-water slurry (CWS) in a piston engine was proposed earlier. In the process, the CWS is first pre-injected into a chamber containing hot gases. There, it water evaporates and then the dried coal particles devolatilize/pyrolyze. Finally, air injected into that chamber triggers combustion. The process improves the CWS ignition and speeds its burning rate. A relatively low pressure level is adequate to pre-inject the CWS; thus, seizure of the CWS pumping-metering system should be avoided. With the process, erosive wear of engine and CWS handling system should be reduced. Work up to the present and planned research is described. 5 references, 4 figures.

10884 (CONF-850530—, pp 670-681) **Use of coal-water fuels in a contemporary steam locomotive.** Ryan, R.B.; Gordon, J.S. (Systematics General Corp., Germantown, MD). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Planning stages are discussed for a feasibility study for the fuel substitution of coal for railroad locomotives. It is proposed that six steam locomotives, manufactured in China, be modified to test coal water slurry combustion, atmospheric fluidized-bed combustion, pulverized clean coal combustion, and two types of coal gasifiers, a two-stage gasifier firebox and a tender-mounted gasifier supplying gas to the firebox. The sixth locomotive, a stoker-fired type, would serve as a baseline. The paper mainly discusses the potential of coal water slurries as a locomotive fuel and the design modifications which will be needed for the locomotive and support systems (fuel preparation, handling, and storage). 6 references, 7 figures, 2 tables.

10885 (CONF-850530—, pp 682-701) **Potential of micronized coal-water slurry as an alternate fuel in oil- and gas-fired boilers.** Haider, G.; Clark, G.A.; Margulies, A.E. (Babcock & Wilcox Co., Alliance, OH). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Slurries made with micronized coals (mass mean diameter, 9 microns) were evaluated as an alternate fuel in boilers designed for oil gas. For comparison, a conventional sized consist coal-water slurry (mass mean diameter, 39 microns) was also evaluated. The evaluation included combustion and deposition tests in the Babcock and Wilcox 200,000 Btu/hr combustor, which was designed to produce ash with properties similar to ash from an industrial or utility steam generators. Based on the successful test series, the results indicate the following. (1) Preheated micronized coal-water slurry (MCWS) can burn like dry micronized coal (MC) with the 200,000 Btu/hr atomizer. (The ability to preheat and properly atomize the fuel is dependent on MCWS and atomizer characteristics which have not been completely defined). (2) The combustion performance and the deposition behavior of MCWS is superior to conventional coal-water slurry (CCWS). (3) The strength of the sintered ash (a measure of sootblower effectiveness to remove the ash deposits in superheater tube banks) was greater from MCWS than that from CCWS. The sintering results usually used to evaluate fouling potential are based on correlations developed for pulverized coal and may not be applicable to the coal-water slurries. The investigation has provided the proof-of-concept that MCWS can burn like dry MC. The data are sufficiently encouraging to consider additional economic studies and possible scale-up testing for proof-of-engineering evaluation. 4 references, 18 figures, 4 tables.

10886 (CONF-850530—, pp 702-716) **Combustion tests of beneficiated and micronized coal-water fuels: use of internal-mix atomizer and rotary-cup burner.** Fu, Y.C.; Bellas, G.T.; Brown, T.D.; Joubert, J.I.; Walbert, G.F. (Dept. of Energy, Pittsburgh, PA). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Combustion tests were conducted in an oil-designed 100-hp firetube boiler using a burner with an internal-mix atomizer to determine the effect of coal beneficiation and coal particle size-consist on combustion properties of coal-water fuels (CWF). Samples of Eastern Kentucky bituminous coal, beneficiated to ash levels of 2.5, 7.8 and 10.3%, were used to prepare CWF's containing ca60% weight coal and having two different particle size-consists, namely ca90% (by weight) minus 75 microns (200 mesh), and 80-90% minus 19 microns (micronized). The viscosity of the micronized CWF increased significantly with shear rate. Combustion test results indicated that the use of the micronized CWF did not result in a significant improvement in either carbon conversion or boiler efficiency compared to the use of the CWF made with coal containing the same percent ash but having the coarser particle size-consist. It appears that atomization quality and the resultant CWF droplet size, and not the coal particle size, determine the rate of fuel burnout and the carbon conversion efficiency. On the other hand, increased levels of coal beneficiation resulted in improvement in the combustion of CWF's. A rotary-cup burner designed and fabricated in-house at PETC was also tested in the 100-hp firetube boiler with both 200-mesh CWF and micronized CWF. Results with both the 200-mesh CWF and the micronized CWF indicate that the rotary-cup burner performs as well as a commercial internal-mix atomizer while giving advantages of lower fuel pressure requirements at the burner, elimination of the need for high pressure atomizing air, and reduced burner erosion problems. 10 references, 6 figures, 10 tables.

10887 (CONF-850530—, pp 734-750) **Coal-water mixture firing in an industrial package boiler: a user's perspective.** Wagner, J. Jr.; Sommer, T.D.; Taylor, B.E.; Johnson, S.A. (Valleydale Packers, Inc., Bristol, VA). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

A coal-water slurry demonstration program at Valleydale Packers, Inc., of Bristol, VA showed that the coal-water mixture (CWM) fuel produced by the United Coal Company (Hydro-Coal) could be fired in a package boiler, designed for natural gas and oil firing, with only a minimum of modifications. While a relatively small amount of fuel was fired over a 2-week period, the data collected during that time defined trends of boiler efficiency, ash deposition, fly ash quantity and particle size distribution, flue gas composition, burner performance, and CWM storage and handling characteristics. The firing of CWM required continuous natural gas support to maintain acceptable flame stability and carbon conversion because minimal burner modifications were made and because the boiler lacked preheated combustion air. Ash accumulation in the boiler could be removed by firing natural gas for several hours. There was no ash manually removed from the boiler at any time during or after the demonstration program. In the event Valleydale Packers decides to fire Hydro-Coal on a long-term basis, the following equipment should be installed: flue gas particulate removal equipment, a CWM burner and air preheater, and an induced-draft fan. In addition, several minor modifications to the fuel handling and storage system and boiler controls should be made. The estimated installed cost of the recommended modifications would be approximately $200,000. While the particulate removal system could add a continuous operating and maintenance cost to the Valleydale operation, the burner and air preheating equipment would raise boiler efficiency by about 5% for all fuels fired. 18 references, 14 figures, 3 tables.

10888 (CONF-850530—, pp 751-760) **Sundbyberg coal water fuel fired boiler - experiences gained between the 6th and 7th International Symposium on Coal Slurry Fuels.** Carlsson, S.A. (Nycol AB, Stora Vika, Sweden). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

In early 1982 a two stage project concerning the use of a beneficiated coal water fuel (CWF) was started in Sweden. The first stage was limited to studies regarding CWF atomization trials in a test rig and to some combustion studies in a test furnace. The findings in this initial effort made it possible to define some performance characteristics aiding the burner selection for the second task. A suitable oil designed boiler for the full scale demonstration in stage two of the project was found at the Sundbyberg District Heating Plant. The conversion of this boiler to CWF was described at the 6th International Symposium on Coal Slurry Combustion and Technology. At the same occasion the first findings from the operation of the boiler on CWF were presented. This paper describes how the continuing commercial use of a beneficiated coal water fuel in the P4 boiler at the Sundbyberg District Heating Plant has progressed between the 6th and 7th International Symposium on Coal Slurry Fuels. 2 references, 4 figures, 3 tables.

10889 (CONF-850530—, pp 761-773) **Experimental study on coal-water slurry combustion on a 20t/h oil-fired boiler.** Xie, M.; Lu, D.; Cao, X.; Cen, K.; Wang, Z.; Chen, F.; Wu, C.Q.; Guo, C. (Zhejiang Univ., Hangzhou, China). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

On the basis of laboratory research, Zhejiang University cooperated with the Institute of Mining of China to perform a series of experiments on CWS combustion on a 20t/h oil-fired boiler in Beijing No. 1 Paper Plant. The oil-fired boiler in Beijing No. 1 Paper Plant was retrofitted for the burning of CWS. First pure CWS combustion succeeded on August 3, 1984. During the test, the boiler provided all the steam needed in production. The combustion efficiency ranged from 93.2 to 94.8% for CWS prepared from Ba Yi Coal, and 95.8 to 97.82% for CWS from Fu Shun Coal. Successive operation time was beyond eight hours. No deposit ash was observed in the furnace with using special jets. This paper descri' es the retrofitting, combustion tests, and storage and pipeline facilities. 12 references, 8 figures, 9 tables.

10890 (CONF-850530—, pp 775-786) **Coal-water-fuel firing experience at Chatham #2.** Cook, D.A.; Kearns, J.D.; Rini, M.J.; LaFlesh, R.C. (Combustion Engineering-Superheater Ltd., Ottawa, Ontario). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

In September 1982, Combustion Engineering-Superheater Ltd. was awarded a contract to develop an atomizer/burner arrangement for firing coal-water-mixture (CWM) in a 20 MW(e), tangentially fired utility unit at Chatham, New Brunswick. A five step procedure was followed in this development work. First, three promising atomizer designs were selected. These designs were then subjected to comparative cold flow atomization performance testing and full scale (70×10^6 Btu/hr) combustion testing at the Combustion Engineering Kreisinger Development Laboratory in Windsor, Conn. This work resulted in the design of an atomizer/burner arrangement, which produced a high quality fuel spray at commercially acceptable atomizing air consumption rates, that was then installed in a 20 MW utility unit in Chatham, N.B. and subjected to additional testing. 5 references, 4 figures, 5 tables.

10891 (CONF-850530—, pp 789-797) **Coal-water fuel developments in eastern Canada: the Chatham and Charlottetown demonstrations and beyond.** Whaley, H.; Rankin, D.M.; Read, P.J.; Covill, I.D. (Energy, Mines and Resources Canada). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Under a cooperative agreement between Energy, Mines and Resources Canada, the New Brunswick Electric Power Commission and the Cape Breton Development Corporation, a 4 t/h preparation facility has been built to produce a coal-water fuel for testing in two small utility boilers located at Chatham, N.B. The formal Chatham project is now completed and this paper presents the results from CWF burner and boiler performance testing in the two units at Chatham, N.B. Under a similar cooperative agreement between Energy, Mines and Resources Canada, Maritime Electric Company Ltd., New Brunswick Electric Power Commission and Cape Breton Development Corporation, funding has been provided to develop burners for testing on Unit No. 10 at the MECL Generating Station at Charlottetown, Prince Edward Island, Canada. This unit is a MW(e) Babcock and Wilcox front-wall fired unit designed for No. 6 fuel oil and is extremely compact in design. Details are given of the status of the unit test program, and modifications, burner selection and pollution control measures being taken in order to be able to operate the unit on CWF during late 1985. 8 references, 3 tables.

10892 (CONF-850530—, pp 811-826) **Introducing indigenous coal-water-mix fuels to the Philippines: assessment of project feasibility.** Bliss, C.; Butcher, T.; Festin, P.M.; Gorden, M.; Kimel, E.A.; Landis, E.R. (Agency for International Development, Washington, DC). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The financial and economic burden of supporting continued import of petroleum, imposed on developing countries, prompted the US Agency for International Development (A.I.D.) to assist the Philippines in their search for means to replace imported oil. The project of transfer and adaptation of coal-water-mix fuel technology to the Philippines is A.I.D.'s first major attempt to provide technical assistance that uses this technology to help alleviate the burden. A.I.D. delegated its responsibilities for accomplishing the assessment to the four organizations identified by the authorship of this paper. Periodic workshops and a number of ad-hoc meetings of the participating teams permitted the necessary coordination and harmonization of the efforts. The overall result is reflected in the Executive Summary and Overview volume of the six-volume final project report of the work. This paper is derived from that volume, and discusses the approach to the problem, the coal source, fuel formulation, power plant retrofit and performance, CWM supply system, economics and national economic benefits, coal conversion alternatives, and results of the project. 7 figures, 5 tables.

10893 (CONF-850530—, pp 855-872) **Performance characteristic of coal-water fuels and their impact on boiler operation.** Hargrove, M.J.; Levasseur, A.A.; Miemiec, L.S.; Griffith, B.F.; Chow, O.K. (Combustion Engineering, Inc., Windsor, CT). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The furnace performance characteristics of a cross-section of Coal-Water Fuels were investigated during comprehensive pilot-scale tests as part of the DOE Combustion Characterization project. The overall objective of this project is to generate a sufficient data base on CWF chemical, physical and combustion properties to assess the potential for commercial use. This paper focuses on the ash deposition and performance behavior of CWFs and their resulting effect on performance and operation of commercial boilers. Specific test objectives include: determination of furnace and convection tube deposit buildup rates; determination of furnace and convection tube heat absorption rates; measurement of relative convection tube erosion rates; measurement of gaseous and particulate emissions; and evaluation of electrostatic precipitator performance characteristics. Data were obtained on eleven different CWFs as well as two baseline pulverized coals. Three coal types were fired at different levels of coal beneficiation to allow assessment of the effects of coal cleaning on performance. Five CWFs were prepared from the same feed coal by different manufacturers to assess the effects of the slurry processing on performance. Test results indicate that for selected high quality coals, CWFs can be fired at the high temperatures associated with tightly designed oil units without serious ash deposition. Coal-type and furnace temperature were the most dominant factors dictating deposit characteristics. Slurry processing did not have a strong direct impact on ash deposition. Coal beneficiation reduced the rate of ash deposition and also significantly reduced the rate of convection tube erosion. 13 references, 16 figures, 10 tables.

10894 (CONF-850530—, pp 883-901) **Retrofit considerations for adding coal-water-mixture fuel capability at Houston Lighting and Power's Sam Bertron Plant.** Arora, B.R. (Houston Lighting and Power Co., TX). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

In quest of our goal of shifting our fuel mix towards coal based fuels, Houston Lighting and Power Company has investigated several alternate fuels for our existing gas and oil capacity. Although other alternate fuels (medium-Btu-gas, methanol, etc.) may be cleaner and better performing than Coal-Water-Mixture (CWM), as a boiler fuel in the current market of petroleum fuels, CWM is more competitive. While considering plant retrofit for adding CWM fuel capability it is necessary to also consider a plant's remaining life and its anticipated mode of operation. This suggests a need for taking an integrated approach to following three major areas of plant retrofit: (a) CWM fuel retrofit for shifting fuel mix towards coal; (b) life extension retrofit for extending capacity beyond anticipated life; and (c) cycling operation retrofit for responding to anticipated operation mode. This paper addresses only CWM fuel retrofit considerations. 6 references, 10 figures.

10895 (CONF-850530—, pp 1111-1128) **Improved combustion of coal water mixtures.** Green, A.E.S. (Univ. of Florida, Gainesville). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

Coal water mixtures (CWM) are promising substitutes for oil, which pump like oil, maintain the infrastructure of utility and industrial oil use and afford environmental benefits through the physical and chemical coal cleaning during slurry preparation. Unfortunately CWM use in oil designed boilers can lead to 30-50% deratings, reduced carbon conversion efficiencies, slagging, fouling, flame instability and other problems. In this study, seven methods are examined for improving CWM combustion to mitigate these problems. These include assist by oil, methanol, oxygen, fine pulverization, improved combustion arrangements, natural gas, and two stage combustion with natural gas. After discussing technical aspects of each method comparative assessments are made of economic, national security, environmental and political aspects of each assist option. 52 references, 7 figures, 2 tables.

10896 (CONF-8507103—1) **Effect of sulfur sorbent and gas cycling on corrosion of FBC materials at 866 K.** Natesan, K. (Argonne National Lab., IL (USA)). Oct 1985. Contract W-31-109-ENG-38. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004046.

From Fluidized Bed Combustion (FBC) materials workshop; Nova Scotia, Canada (29 Jul 1985).

Metallic materials selected for the construction of in-bed heat exchangers in fluidized-bed combustion (FBC) systems must withstand the corrosive conditions prevalent in these systems. Oxidation/sulfidation interactions leading to accelerated metal wastage of in-bed materials can occur due to the presence of sorbent deposits on the tube surfaces and/or the presence of low levels of oxygen partial pressures in the exposure environment. The present paper discusses the possible mechanisms for sulfidation of iron-base ferritic and austenitic alloys and the roles played by key parameters such as sorbent chemistry, gas chemistry, and gas cycling conditions on the corrosion process. The 200-h test results from the laboratory materials evaluation program and the available data on characterization of in-bed environments are used to assess the corrosion behavior of in-bed materials in FBC systems. 14 refs., 19 figs., 4 tabs.

10897 (DOE/ET/17086—1932, pp 1.47-1.86) **Fundamentals of coal dust combustion: recommendations for research on explosive limits of coal dust.** Krier, H.; Buckius, R.O. (Univ. of Illinois, Urbana). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

This paper reviews the combustion of coal including coal dust-air explosions. It covers: (1) combustion of particulates, including the amount of volatile matter, chemical reaction rates, particle size, ignition temperature, etc.; (2) the behavior of dusts in small flames of various size with measurements mostly of flame propagation as affected by particle size, oxygen partial pressure, etc. These small flames are hard to stabilize on account of large heat losses and the measured propagation velocities are of the order of 1 to 10 cm/sec.; and (3) the behavior of large clouds where conditions are nearly adiabatic and propagation velocities of the order of 1 m/sec. are measured. Future research needs in this area are considered. 52 refs. (LTN)

10898 (DOE/ET/17086—1932, pp 2.1-2.26) **Conventional combustion.** Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

There were twenty-two participants in the Conventional Combustion workshop. There were three representatives from boiler manufacturers, six consulting engineers, four from government research facilities, three from commercial coal research facilities, four from utilities burning low-rank coals and two from academia. Prior to the workshop the sponsor had prepared and distributed to the participants a set of background statements relating to perceived needs for research on low-rank coal combustion. This material was used as the outline and basis for discussion at the workshop. Prepared presentations on various aspects of low-rank coal combustion were presented at the workshop. Each of the proposed research topics was discussed at the workshop and a consensus was reached as to the need for further research on each of the topics. Some of the original research topics were dropped and others were added in the course of the discussions. At the close of the discussions all of the agreed upon research topics were rated as either higher or lower priority. Research topics, with priority ranking, are listed in Table 2-1.

10899 (DOE/ET/17086—1932, pp 2.27-2.47) **Combustion and pollutant-forming characteristics of low-rank western coals.** Malte, P.C. (Univ. of Washington, Seattle). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

Low-rank western coals have moisture contents which are large (25 to 50 wt %), volatile levels (25 to 35 wt %) which are similar to fixed carbon levels (25 to 45 wt %), organic oxygen levels which are high (O/C atom ratios of 0.15 to 0.3), and sulfur levels which are generally less than 1 wt %. Boiler fouling potentials are high when high sodium lignites (Na_2O > 5% in ash) are burned. The high moisture and high organic oxygen result in low fuel heating values of 6000 to 10,500 Btu/lb, and low flame temperatures. The resultant low flame radiation intensity, in conjunction with the fouling potential, means that increased furnace size is needed. The heating of low-rank coals yields volatiles which are mainly light gases (H_2O, CO_2, CO, and some light organics); tar yields are minimized. Oxides of nitrogen emissions may be lower than with other coals, because of the reduced flame temperatures, and because of somewhat lower fuel-N contents (about 1 wt %). The volatile fuel-N is mainly HCN released in the latter stages of particle devolatilization. With precise staging, this can be reacted to N_2. About one-half of the fuel-N appears to remain as char-N, reacting to NO and N_2 in a manner similar to other coals. Because of the high levels of calcium and alkali metals found in low-rank coals, about 20 to 25% of the fuel-sulfur is retained in the ash, and not released to the gas-phase in PC-fired boilers. For coals with Ca/S > 1, careful air staging and temperature control may lead to further reductions in emitted SO_2 and SO_3. 36 refs.

10900 (DOE/ET/17086—1932, pp 4.1-4.23) **Fluidized bed combustion.** Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

The twelve participants in the Fluidized Bed Combustion Workshop included six representatives from government research facilities, five representatives from private sector research, engineering, or vendor firms, and one representative from EPRI providing a utility perspective. The background statements which had been prepared on the agenda topics wre used as a starting point for

the discussion. Table 4-1 lists the agenda topics and indicates the prepared presentations that were given to initiate discussions. Each of the proposed research topics was discussed at the workshop, and a consensus was reached as to the need for further research in each of the topics. Some of the original research topics were dropped and others were added in the course of the discussions. At the close of the discussions, all of the agreed-upon research topics were rated as either higher or lower priority. The research topics, with priority rankings, are listed in Table 4-2.

10901 (DOE/ET/17086—1932, pp 4.25-4.44) **Technical and economic aspects of a lignite-fired AFBC boiler.** McGowin, C.R.; Aulisio, C.; Ehrlich, S. (Electric Power Research Institute, Palo Alto, CA). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

Atmospheric fluidized bed combustion (AFBC) is well-suited for direct combustion of lignite and other low rank coals. Potential advantages relative to pulverized-lignite combustion include reduced sensitivity to coal quality and variability, elimination of boiler fouling and slagging problems, higher sulfur capture by alkaline ash, and elimination of flue gas desulfurization. EPRI is evaluating two AFBC design concepts for utility boiler application: (1) an AFBC boiler with recycle of solids to the main bed, and (2) a circulating fluid bed (CFB) boiler operating at relatively high velocity and recycle rate. North Dakota Beulah lignite was recently tested at the EPRI Fluidized Bed Development Facility in Alliance, Ohio. The tests were conducted without solids recycle and confirmed the high combustion efficiency expected for reactive lignite, high sulfur capture by the alkaline ash, insensitivity to fuel quality and variability, and absence of fouling and slagging. Other lignite tests, conducted in circulating fluid bed combustion pilot plants during 1981, have demonstrated low NO/sub x/ emissions, high sorbent utilization, and high combustion efficiencies. Conceptual design and economic evaluations sponsored by EPRI indicate a 10 to 20% savings in total capital and revenue requirements for the lignite-fired AFBC/recycle boiler relative to an equivalent pulverized-lignite boiler with a wet flue gas desulfurization (FGD) system. Due to the potential advantages for low rank coal, it is possible that the first utility-scale application of AFBC will be with a low-rank coal. 14 refs., 9 figs., 11 tabs.

10902 (DOE/ET/17086—1932, pp 4.45-4.65) **Fluid bed combustion bed properties with LRC.** Molen, R.V. (Combustion Power Co., Inc., Menlo Park, CA). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

During the past two years, a series of 15 tests was conducted at CPC utilizing a Beulah seam North Dakota lignite, and three tests (12 test points) using two Texas lignites. This paper will briefly discuss the effect of the various test parameters on bed properties and the resulting effect on operating conditions resulting from those bed properties. 10 figs., 4 tabs.

10903 (DOE/ET/17086—1932, pp 4.67-4.89) **Hot gas cleanup for pressurized fluidized bed combustion burning low rank coal.** Markel, K.E. Jr. (Morgantown Energy Technology Center, WV). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

An electrical generating station based on a pressurized fluidized bed coal combustor (PFBC) powering a gas turbine generator offers environmental and efficiency advantages over a conventional pulverized coal (PC) boiler powering a steam turbine generator. The PFBC meets the sulfur and NO/sub x/ emission regulations without the use of add-on control devices. Further, it is 4 to 6 points more efficient than the PC boiler in converting coal to electrical energy. The major technical issue yet to be resolved for the PFBC system is how to remove the particulate and alkali contamination from the hot pressurized combustion gases prior to introducing the gas into the gas turbine. The Department of Energy, under the Advanced Environmental Control Technology (AECT) Program, is addressing that issue as part of the Hot Gas Cleanup (HGC) Project. The emphasis of the project is on systems burning high rank, eastern coals. This paper discusses the potential effects burning low-rank coal western coals may have on the operation and design of the hot gas cleanup concepts being investigated. A brief discussion of the PFBC Gas Cleanup requirements, followed by a review of the differences in low-rank and high-rank coals and the general effect those differences have on the combustion gases provides a basis for the discussion. The structure of the HGC project is then outlined. Finally, a description and status report of each concept is detailed. 18 figs.

10904 (DOE/ET/17086—1932, pp 5.29-5.32) **Viscosity of low-rank coal slags.** Diehl, E.K. (Bituminous Coal Research, Inc., Monroeville, PA). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

As the project progresses, it becomes more apparent that the important factors to be considered in developing an ash composition/viscosity relationship are the actual mineral forms that exist in the coal ash. Equations based on the normal ash analysis, where the ratios of elements are listed as oxides, appear to fall short. The BCR work has shown that two coal ashes having essentially identical analyses, based on the ratios of oxides, display completely different viscosity behavior. A further complication is the observation that most of the slags tested thus far develop two or more liquid phases which have distinctly different viscosity characteristics. Thus, it becomes difficult to determine what the measured viscosity means. Despite the problems and surprises that have arisen as the project proceeds, it is hoped that with the accumulation of sufficient data, the objective can be met. 4 refs.

10905 **(DOE/PC/60801—8) Combustion of calcium-exchanged coal. Eighth quarterly report.** Gavalas, G.R.; Flagan, R.C. (California Inst. of Tech., Pasadena (USA)). Dec 1985. Contract FG22-83PC60801. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004349.

In the seventh quarterly report we included experiemntal procedure and some results from devolatilization experiments of acid-washed and calcium-exchanged HVA bituminous coal (PSOC 767). To confirm the char yield measurements based on the weight of collected char, we sent selected char samples to Galbraith laboratories for analysis of iron content. The char yield was then calculated assuming that all iron remains in the char. The char yields computed from these two different measurements are compared in Table 1. The two values generally agree within +- 10%. Weight loss is higher for the calcium exchanged coal. The sulfur content of chars from acid-washed and calcium-exchanged coal was reported in the previous report. The sulfur content is higher in the chars of the calcium-exchanged coal. Sulfur retention is proportional to the yield of char and the sulfur content in the char. Because these two quantities are affected in the opposite direction by the calcium additive, sulfur retention of the calcium-exchanged coal is only slightly higher than that of the acid-washed coal.

10906 **(DOE/PC/60802—T4) Aerosol formation from pulverized coal combustion. Quarterly report No. 7.** Linak, W.P.; Peterson, T.W. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). 1 Jun 1985. Contract FG22-83PC60802. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004513.

Data from 51 combustion runs involving six types of pulverized coal and an Israeli oil shale were analyzed. The six coal types included a Utah bituminous coal, two batches of a Beulah (North Dakota) low sodium lignite (No. 1 and No. 2), a Beulah (North Dakota) high sodium lignite and two batches of a Texas (San Miguel) lignite (No. 1 and No. 2). In all, over 2600 separate particle size distributions and over 130 filter samples involving over 250 sampling and combustion conditions were taken. Combustion configurations include standard, unstaged, SR = 1.2 (base case) conditions, staging conditions of .8/1.2, .7/1.2 and .6/1.2 and oxygen enrichments of 24.6 and 30% O_2. Data is presented on average NO/sub x/ concentrations for all six coal types. 4 refs., 5 figs., 15 tabs.

10907 **(DOE/PC/60802—T6) Aerosol formation from pulverized coal combustion. Quarterly report No. 8.** Linak, W.P.; Peterson, T.W. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). 1 Sep 1985. Contract FG22-83PC60802. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004514.

Aerosols produced on combustion of pulverized coals, lignite and shale oil were studied with respect to particle size distributions. 16 refs., 36 figs., 4 tabs. (DT)

10908 **(DOE/PC/70764—3) Effect of in-situ heat treatment on coal char reactivity. Engineering kinetics of coal pyrolysis and combustion in normal and high intensity flames. Progress report.** Essenhigh, R.H. (Ohio State Univ., Columbus (USA). Dept. of Mechanical Engineering). Sep 1985. Contract FG22-84PC70764. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86003908.

The objective is to determine whether char reactivity can be significantly reduced by millisecond heat treatment times. Data evaluation has required development of additional activities, focussing on engineering kinetic requirements for evaluation modelling, as described following. The hypothesis for test in these experiments is that the very high heating rates involved in this system (about E6 deg/sec) is substantially eliminating in-situ heat treatment of the flame-formed char that would otherwise reduce the char reactivity to a "normal" value. To test this hypothesis secondary air is being supplied in these experiments some variable distance below the primary zone to permit heat-treatment of the flame-formed before burn-out. The complexity of the behavior of the experimental system, however, requires determination of the kinetic rate constants by comparison with flame models; and because of some complex backmix behavior in the flame, a further requirement of the modelling is representation of the kinetics in a form that is computer-tractable in the flame model but will yet yield results of a "necessary and sufficient" accuracy.

10909 **(DOE/PC/70764—4) Effect of in-situ heat treatment on coal char reactivity. Ostwald equations and combustion efficiency in hydrocarbon and coal flames. Progress report.** Essenhigh, R.H. (Ohio State Univ., Columbus (USA). Dept. of Mechanical Engineering). Nov 1985. Contract FG22-84PC70764. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86003944.

The Ostwald Equations have been in use for about 60 years as a means of cross-checking the accuracy of gas analyses taken in the exhaust of hydrocarbon (CH/sub x/) or coal (CH/sub x/O/sub y/) flames, or along the path of combustion if certain limitations are met. The accuracy of the analyses is important if they are to be used for calculation of combustion efficiency, and especially of combustion efficiency profiles along flames. This Note is a summary of the Ostwald and Combustion Efficiency equations, with an outline of the derivation steps for reference. The Ostwald Relations provide a cross check on the accuracy of the gas analyses in hydrocarbon flames. They also constitute a carbon balance between the fraction entering in the fuel and that present in the POC, if all fuel has been gasified and is present as CO_2 or CO. If all the fuel has not been gasified and is then present as condensed phases (liquid drops or solid particles) the gas analyses can be used to calculate the combustion efficiency if there are no intermediates at significant concentrations. The equations also hold if unburned gaseous fuel is present but the gas analyses are corrected to a fuel-free basis (comparable to a dry basis). If the fuel disproportionates in its reaction (as in pyrolysis of coal with prior combustion of the volatiles), the combustion efficiency must be calculated in two stages. Neglect of this disproportionation behavior can result in errrors in calculated combustion efficiency of as much as 10%.

10910 **(DOE/PC/80752—T2) Detailed model for practical pulverized coal furnaces and gasifiers. Quarterly technical progress report No. 2, August 1-October 31, 1985.** Smith, P.J.; Smoot, L.D. (Brigham Young Univ., Provo, UT (USA). Combustion Lab.). 30 Nov 1985. Contract FG22-85PC80752. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86003942.

On May 1, 1985, work was initiated on a contract sponsored by a consortium of industrial and government agencies aimed at development of a practical 3-D coal combustion model applicable to utility and industrial furnaces and gasifiers. A review of available numerical methods resulted in a rating of these techniques to determine the most promising methods. Further study of each of these methods has been conducted. Examination of the three leading numerical methods revealed that each technique had its own distinct strengths and weaknesses. All three methods possess sufficient promise to continue investigation on their application to the three-dimensional combustion code. Special attention is being given to integrating the new numerical methods with the existing submodels. At the same time, the extension of PCGC-2 is carefully studied as a guaranteed solution, if the newer, more promising but less well developed methods fail to produce acceptable results. Work was initiated on: (1) a rigorous sensitivity analysis of model parameters; and (2) a detailed evaluation of selected submodels. Work has been accomplished in improving and evaluating the turbulent particle dispersion submodel, chemistry and turbulence interactions, the radiation submodel, the NO/sub x/ submodel, and the particle reaction submodels. Progress in each of those areas is reported in this report. 36 refs.

10911 **(DOE/PETC/QTR—85/3) Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985.** (USDOE Pittsburgh Energy Technology Center, PA). Jan 1986. 146p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86004954.

Flue gas cleanup research resulted in a number of successful tests this period. A series of PETC tests showed that the simultaneous removal of sulfur dioxide and nitrogen oxides from the flue gas of a coal-fired boiler can be achieved using a spray dryer. The addition of sodium hydroxide to the lime slurry sorbent conventionally used in spray dryer desulfurization systems significantly enhanced the absorption of nitrogen oxides from flue gas. Tests conducted in a microbalance reactor at PETC demonstrated that hydrated ceric oxide is a promising sorbent for flue gas cleanup applications over a wide temperature range. Further testing of this material will be conducted to verify its potential for simultaneous SO_2/NO/sub x/ removal from the flue gas of coal-fired electric power generating facilities. Over 80 responses were received to a Request for Proposals for further development and proof-of-concept testing of the PETC-developed Fluidized-Bed Copper Oxide Process. Since a chelate can be fixed on a solid substrate material, a simple wet scrubbing system, similar to a dual alkali process, might be utilized for at least 90% simultaneous SO/sub x//NO/sub x/ control. This quarter, Foster-Miller was able to fix one of the more promising chelates on a substrate. The Liquid Phase Methanol PDU at LaPorte completed forty days of highly successful operation with CO-rich syngas and a 25 wt % catalyst slurry. Planned modifications to the Wilsonville PDU include the addition of a new ebullated-bed reactor with associated piping and instrumentation. A test program to evaluate the potential advantages of dense-phase transport and combustion of pulverized coal was initiated in the PETC 100-hp combustion test facility.

10912 **(DOE/PETC/TR—86/3) Flow characteristics of coal-water mixtures. Final report, September 1, 1981-September 30, 1984.** Ekmann, J.; Wildman, D.; Mathur, M.; Klinzing, G. (USDOE Pittsburgh Energy Technology Center, PA; Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Jan 1986. 183p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86005397.

Coal water mixtures have been transported in a recirculating test loop facility. A complete description of the test facility is given. Details of slurry preparation and handling procedures, as well as test procedures, are presented. Test results that examine additive effectiveness and effects of slurry age are discussed. Parametrization tests were conducted on temperature, particle size distribution, concentration, coal type, and pipe diameter. Metzner-Reed coefficients were calculated for the different concentrations and particle size distributions. During this series, different commercial instrumentation was tested for reliability with coal-water slurries. Tests were conducted at different pH values to quantify the effect of pH on pressure drop. Transient behavior was studied during step changes in the mass flow rate. Visualization of flow patterns in bends and elbows was studied using slurries prepared with a white vinyl powder. Three commercially available slurries and two mixes

under commercial development were tested. Handling and transport problems are discussed. Several of the classical correlations were applied to the data with limited success. A modeling approach developed for horizontal turbulent flow was modified for laminar flow. Results of this effort show an improvement over classical methods. Correlations for homogeneous flow around bends and elbows are modified for slurries. 16 refs., 38 figs., 8 tabs.

10913 **(ERP/ERL—84-31) Development of a bench-scale fluidized bed combustor for coal reactivity studies.** Lau, I.T. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Jun 1984. 32p. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

A bench-scale FBC unit has been developed to rank the apparent reactivity of various coals when burned by fluidized bed combustion. In developing experimental methods and procedures for the reactivity measurement, preliminary runs were conducted with a blended Pennsylvania coal. Results show that the combustion rate is highly affected by the coal particle size which is consistent with the shrinking sphere model. The effect of other operating parameters such as bed temperature, oxygen level, and fluidizing gas velocity was also investigated. (27 refs.)

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 10815, 10828, 10841, 10861, 10878

10914 (CONF-850530—, pp 1083-1097) **Capital and operating costs for commercial scale coal-water slurry preparation plants.** Furman, R.C. 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

The commercial scale plants that are described have a capacity of two million tons of coal per year. Each of the major systems of the plants are described and cost estimates are developed for each major equipment category. The operating costs are described and a comparison is provided of costs both with and without coal cleaning in the preparation processes. The coal handling systems consist of coal unloading, storage and crushing equipment. The slurry preparation systems consist of coal grinding, froth flotation coal cleaning, filtering and water treatment equipment. The slurry handling systems consist of storage tanks and barge loading equipment. The auxiliary systems consist of utilities, buildings, ash disposal, laboratory facilities and control systems. Capital cost estimates include equipment costs, site improvements, construction management, engineering and construction costs. The operating cost estimates include the cost for chemical additives, power, labor, coal losses and ash disposal. Using both capital and operating cost estimates the total CWS costs (F.O.B preparation plant) are developed in terms of cost per ton of coal, cost per ton of CWS, and cost per million Btu. Important factors that affect the cost of the delivered CWS are also discussed. 8 references, 3 figures, 3 tables.

10915 (CONF-850530—, pp 1098-1107) **Coal slurry production costs.** Linnig, D.A. (Fluor Technology, Inc., Irvine, CA). 1985. NTIS, PC A99/MF A01. File Number DE85012244.

From 7. international symposium on coal slurry fuels preparation and utilization; New Orleans, LA, USA (21 May 1985).

A group of engineers from Fluor's Advanced Technology Division were assigned the task of evaluating the economics of coal-water slurry fuel production. The study effort involved preparation of a preliminary conceptual design, capital and operating cost estimates, and discounted cash flow analysis for a project to produce 1.2 million tons per year of a typical coal-water mixture (CWM). Various parameters, including additive formulation, site location, and plant capacity were examined to determine their relative impact on the ultimate CWM price. 9 figures, 8 tables.

10916 (DOE/METC—85/5, pp 263-270) **Critical economic parameters for underground coal gasification.** Davis, B.E.; Lindley, P.A. (Gulf Research & Development Co., Pittsburgh, PA). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

Gulf has developed a process economic model that can evaluate the effects of varying the UCG process parameters. Fuel gas production at less than $3.00/mmBtu is likely as a commercial competitor with synthesis gas transfer prices estimated to be below present Gulf coast costs.

10917 **(ERCB—ST-85-29) Alberta's coal industry - annual statistics at 31 December 1984.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). May 1985. 45p. Energy Resources Conservation Board, Calgary, Alberta, Canada.

This annual report reviews the Alberta coal industry in 1984. Statistics are presented for 1) production of subbituminous coal, 2) supply and disposition of subbituminous coal, 3) production of bituminous metallurgical and thermal coal, 4) supply and disposition of bituminous metallurgical coal, 5) supply and disposition of bituminous thermal coal, 6) preparation plant operations for bituminous coal, 7) supply and disposition of bituminous metallurgical clean coal, 8) supply and disposition of bituminous thermal clean coal, 9) summary of coal inventories, and 10) coal exploration. An historical summary of production, supply, and disposition is given for 1975-1984.

10918 **(ORNL—6184) Factors affecting the rent to surface-mined coal tracts in the Powder River Basin and Green River/Hams Fork Region.** Jones, D.W.; Hillsman, E.L.; Lee, R.; Foust, C.B. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 74p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86005339.

This study develops a method to estimate annual rent to a coal tract which requires knowledge only of tract geological characteristics, mining technology characteristics derived from production function estimates, and prices. Cobb-Douglas and Constant Elasticity of Substitution production functions were estimated for twenty mines in the Powder River Basin and Green River/Hams Fork Region, using data on capital, labor, and energy inputs and data describing tract geological characteristics. The analysis found constant returns to scale and no effects of depletion on mining costs. The Cobb-Douglas specification appeared satisfactory. Surface coal mining in these two regions appears much less capital-intensive than nationwide estimates for surface coal mining previously offered. Of the geological characteristics considered in the analysis, only remaining reserves appear appropriately viewed as an input to mining. The stripping ratio (ratio of overburden to seam thickness) has a negative effect on tract rent. Almost exactly 12.5% of the value of output is attributable to the tract itself; so, keeping in mind the limitations of the data base and the statistical nature of the estimate, we suggest that the current federal royalty rate of 12.5% probably extracts a share of revenue very close to the government's "proper" share as owner of the tract. 20 refs.

0160 Health And Safety

REFER ALSO TO CITATION(S) 10823, 11398

10919 **(CONF-8511136—3) Toxicological beneficiation of coal liquids and comparison with petroleum products.** Griest, W.H.; Ho, C.; Witschi, H.R.; Smith, L.H.; Guerin, M.R. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004799.

From Direct liquefaction contractors conference; Pittsburgh, PA, USA (19 Nov 1985).

Research at the Oak Ridge National Laboratory on the toxicological properties of coal-derived liquids is focused on characterizing finished products and toxicity beneficiation processes. The primary emphasis is placed on comparing the dermal tumorigenicity of coal and petroleum-derived fuels and identifying means of reducing the toxicity of crude coal liquids. This paper summarizes the results of a toxicological comparison of crude and hydrogenated coal liquids, and of naphtha and home heating oil products refined from coal liquids and petroleum. Catalytic hydrogenation and alternate or supplemental refining processes are examined for their utility in

the toxicological beneficiation of crude coal liquids. Catalytic hydrogenation is found to be a very effective means of reducing the tumorigens and tumorigenicity in crude coal-derived liquids to levels comparable to those of petroleum equivalents. However, a residual tumorigenicity remains even in products subjected to high severity hydrogenation. Variations in catalyst, hydrogenation conditions, or combining sample pretreatments with hydrotreatment may allow further reduction in tumorigenicity. 15 refs., 5 figs., 12 tabs.

10920 **(DOE/ET/10069—T119) EDS Coal Liquefaction Process Development. Phase V. Quarterly technical progress report, July 1-September 30, 1985.** (Exxon Research and Engineering Co., Annandale, NJ (USA)). Nov 1985. Contract FC05-77ET10069. 104p. (FE—2893-158). NTIS (US Sales Only), PC A06/MF A01; 1; GPO Dep. File Number DE86005092.

Highlights from this report, EDS toxicology program, are summarized as follows. They are grouped according to their corresponding reporting categories in the report. Repeated oral dosing of EDS recycle solvent to rats at levels of up to 0.5 g/kg/day, five days per week for 13 weeks did not produce evidence of substantial systemic toxicity. EDS recycle solvent was administered orally to pregnant female rats from days 6 to 19 of gestation. The number of live fetuses declined in a dose-related manner. Repeated exposure to EDS recycle solvent and EDS Fuel Oil is unlikely to substantially affect reproductive capacity or performance. This conclusion is based on results from a study in which doses of up to 0.5 g/kg/day of test material were administered orally to male and female rats 5 days per week for thirteen weeks. The water soluble fractions of EDS recycle solvent and fuel oil demonstrated moderate levels of acute toxicity to aquatic organisms. The water soluble fraction of hydrotreated naphtha demonstrated significantly lower acute toxicity. Chronic studies showed effects at levels of 0.1 to 0.01 of the acute effect levels. Algal studies demonstrated that the water soluble fractions of recycle solvent could stop algal growth but would not kill algae. In a simulated ecosystem, the water soluble fractions of EDS liquids degraded fairly rapidly, accompanied by a corresponding decrease in toxicity, suggesting that EDS materials are unlikely to persist in the environment in their acutely toxic forms for extended periods of time. Two EDS recycle solvents and EDS Fuel Oil were found to be active dermal carcinogens in lifetime mouse skin painting tests. Hydrotreated naphtha was inactive. A comparison of the potency of EDS high boiling liquids to SRC-II high boiling liquid and coal tar pitch indicates that EDS liquids do not pose a greater dermal carcinogenic hazard than other coal derived materials of similar boiling range. 53 refs., 13 figs., 30 tabs.

10921 **(DOE/PC/62999—8) Exploratory research on mutagenic activity of coal-related materials using statistical evaluation.** (Cincinnati Univ., OH (USA). Kettering Lab.). [1985]. Contract AC22-83PC62999. 100p. NTIS, PC A05. File Number DE86004358.

Potential synergism among components of fuel-derived mixtures is being investigated by comparison of mutagenic activities of "reconstructed wholes" with the sum of mutagenic activities of individual fractions. Results of assays of sample Lummus Product (Lum. Prod.) Fraction IV were somewhat equivocal, giving indications of loss of material with fractionation. Data from assay of sample Lummus Feed (Lum. Feed), by contrast, gave indications of the likelihood of interactions among fractions contributing to increased mutagenicity. The ability of fuel sample fractions to influence biological activities of individual components also being studied. In these mutagenicity assays 2-aminoanthracene (2AA), as a model aromatic amine, is tested in the presence of the hexane fraction of PDU-9. Data from these assays show an enhanced mutagenic response as a result of mixing these two materials. 8 tabs.

10922 **(ORNL/FETEP—15) Guidance document for prioritizing supplemental monitoring around synfuels facilities.** Jones, T.D.; Walsh, P.J.; Witherspoon, J.P.; Suter, G.W. II; Barnthouse, L.W. (Oak Ridge National Lab., TN (USA)). Jan 1986. Contract AC05-84OR21400. 128p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86005344.

Recommended screening methods for exposure, health-effects, and ecological-effects assessments are given. Exposure assessment methods are used for both health-effects and ecological-effects assessments. However, potential targets for health effects and ecological effects differ greatly so that a common methodoogy to manage supplemental monitoring activities is not practical. For health effects, a new rapid chemical-scoring method based on relative-potency comparisons is used. Permissible concentrations, and estimates of uncertainty, in air, water, and the workplace are given for 58 example chemicals. By using the data listed in the Registry of Toxic Effects of Chemical Substances (RTECS), the new method adequately imitated the accuracy of the careful analyses of the Criteria Documents, CAG, ACGIH, and the EPA activities which draw heavily on expert judgement, analytical tools, and require much time for each chemical considered. The new system is a recommended tool for estimating trigger values and management of priorities for currently unregulated chemicals. For ecological effects, a detailed decision tree leads one from the results of effluent chemical analysis or toxicity tests to decisions on additional monitoring/testing. Techniques for calculating toxicity benchmarks for aquatic and terrestrial systems are presented. Methods for deciding whether to use acute toxicity data or to conduct additional chronic and subchronic tests are described. 28 refs., 7 figs., 10 tabs.

10923 **(PB—85-235786/XAB) Rollover protective structures (ROPS) inspection and maintenance guide. Information circular/1985.** Swan, S.A.; Jones, D.C.; Niziol, K. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1985. 21p. (BM-IC—9009). NTIS, PC A02/MF A01.

The illustrated manual provides mine safety personnel, the Mine Health and Safety Administration (MSHA) inspectors, and original-equipment manufacturers with guidelines and a checklist for inspecting Rollover Protective Structures (ROPS) being used in the field. The manual discusses specific requirements of the MSHA regulations and minimum inspection and maintenance checks for ensuring compliance with those regulations. An easily reproducible checklist is provided as an aid to the inspection of ROPS.

10924 **(PB—85-236453/XAB) Factors affecting respirable dust generation from longwall roof supports. Information circular/1985.** Organiscak, J.A.; Listak, J.M.; Jankowski, R.A. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1985. 27p. (BM-IC—9019). NTIS, PC A03/MF A01.

The Bureau of Mines conducted a survey of eight shearer longwall operations to identify factors that affect respirable dust generation from longwall roof supports. The longwalls surveyed were in coal seams located in different geographic regions of the United States. Data were collected on mining (geologic) conditions, support design, operational characteristics, and amount of respirable dust generated from roof supports. Several practices are currently employed to effectively control roof support dust.

10925 **(PB—85-236479/XAB) Recognizing signs of excessive loading in underground coal mines. Information Circular/1985.** Bauer, E.R. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1985. 38p. (BM-IC—9017). NTIS, PC A03/MF A01.

The Bureau of Mines publication describes and illustrates the physical signs of excessive loading on mine roof supports, installations, and openings. It is designed to assist mine personnel in recognizing potentially hazardous ground conditions, by emphasizing the preliminary effects of developing unstable ground. Increased worker awareness can be expected to reduce the injuries and fatalities resulting from falls of roof, rib, and face.

10926 **(PB—85-240406/XAB) Demonstration of shield-type longwall supports at Kaiser Steel Corporation's No. 1 mine, Utah. Open File report February 1980-April 1982.** Hawley, P.M.; Hood, M. (Kaiser Steel Corp., Sunnyside, UT (USA)). May 1983. 51p. NTIS, PC A04/MF A01.

The performance of approximately 115 shield supports employed in 2 panels at Kaiser Steel's Sunnyside No. 1 Mine is described. These Hemscheidt 320 HSL caliper-type shields were installed originally at Kaiser's York Canyon Mine as a demonstration program and later were transferred to Sunnyside. This report de-

scribes the rehabilitation of the shields prior to their installation at this second mine and the mining experience using these supports. One of the interesting features of the Sunnyside panels is the wide range in seam heights (from about 6 ft to about 10 ft) within each panel.

10927 **(PNL-SA—13266) Comparative biology and chemistry of boiling point fractions from different coal liquefaction processes.** Wright, C.W.; Chess, E.K.; Stewart, D.L.; Mahlum, D.D.; Later, D.W.; Lucke, R.B.; Pelroy, R.A.; Wilson, B.W. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1985. Contract AC06-76RL01830. 27p. (CONF-8510225—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004403.

From Hanford life sciences symposium; Richland, WA, USA (21 Oct 1985).

Data on the chemical composition and toxicologic activity of narrow boiling point (bp) range distillate cuts from the non-catalytic solvent refined coal-I and -II processes, as well as from the catalytic H-Coal, EDS, and integrated two-stage liquefaction processes, were compiled and compared. Results revealed that processes using catalysts contained higher concentrations of alkylated and hydrogenated polycyclic aromatic hydrocarbons (PAH). In addition, lower concentrations of nitrogen-containing polycyclic aromatic compounds (NPAC), including amino-substituted PAH, were present in those materials from processes which used some form of catalytic hydrogenation. Regardless of process, the hydrogen content decreased and the nitrogen, oxygen, and sulfur heteroatomic content of the coal liquefaction materials increased as a function of increasing distillation temperature. In addition, aliphatic hydrocarbon content decreased while the NPAC and hydroxy-substituted PAH content increased as a function of increasing bp temperature for all the coal liquefaction materials. 18 refs., 8 figs., 10 tabs.

10928 **(PNL-SA—13284) Methodologies for the separation of chemical classes from coal liquefaction materials.** Wright, C.W.; Chess, E.K.; Lucke, R.B.; Weimer, W.C.; Later, D.W.; Stewart, D.L.; Mahlum, D.D.; Wilson, B.W. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1985. Contract AC06-76RL01830. 29p. (CONF-8510225—5). NTIS, PC A03/MF A01; GPO Dep. File Number DE86004877.

From Hanford life sciences symposium; Richland, WA, USA (21 Oct 1985).

Methods have been developed for the separation of the following chemical classes from complex coal liquefaction matrices by alumina column chromatography: aliphatic hydrocarbons, polycyclic aromatic hydrocarbons (PAH), nitrogen-containing polycyclic aromatic compounds (NPAC), and hydroxy-substituted PAH. Fractional distillation prior to column chromatography has been used as an additional means of reducing the chemical complexity of coal liquefaction materials. When the above fractions were tested for biological response in microbial mutagenicity and initiation/promotion mouse skin tumorigenicity assays, it was found that the majority of the mutagenicity was associated with the NPAC fractions. These two biologically active fractions were, therefore, further subfractionated. The NPAC fractions were separated into secondary amine (carbazoles), primary aromatic amine (amino-substituted PAH), tertiary amine (aza arene), and cyano-substituted PAH subfractions by column chromatography. The majority of the microbial mutagenicity was isolated in the amino-substituted PAH subfraction. The PAH (and hydroxy-PAH) fraction was subfractionated by molecular weight using reverse-phase high pressure liquid chromatography (HPLC). The majority of the tumorigenicity of the PAH fractions was not completely concentrated into any one HPLC subfraction. As coal liquefaction processes have evolved, the products have become more highly alkylated and hydrogenated. The hydroaromatic species in the coal liquefaction materials have been separated from the PAH species by picric-acid-coated alumina column chromatography. The hydroaromatic species were found to exhibit little to no mutagenic or tumorigenic response. 21 refs., 8 figs.

10929 **Application of acute bioassays in evaluating the treatment of coal liquefaction wastewaters.** Feeley, T.J. III; Drummond, C.J. (Dept. of Energy, Pittsburgh, PA). *Bulletin of Environmental Contamination and Toxicology;* **35**: No. 2, 249-257(Aug 1985).

This paper presents results of acute bioassays performed on untreated coal liquefaction process wastewater and the wastewater following a series of treatment steps. The objective of this study was to determine the applicability of acute toxicity tests in evaluating the effectiveness of an integrated wastewater treatment strategy and selected treatment unit operations in reducing the contaminants present in the wastewater. In addition, the relative contribution of the major organic and inorganic components to the total acute toxicity of the wastewater was examined.

02 PETROLEUM

0203 Drilling And Production

10930 **(AD-A—158054/7/XAB) Analysis of the potential for enhanced oil recovery in the Shannon Formation at Naval Petroleum Reserve Number 3. Master's thesis.** Chappelle, H.H. (Texas Univ., Austin (USA)). May 1985. 181p. NTIS, PC A09/MF A01.

Three EOR processes were evaluated for potential application in the Shannon reservoir at Naval Petroleum Reserve No. 3, in the Teapot Dome Oilfield near Casper, Wyoming. This reservoir is estimated to have originally held 180 million barrels of oil, of which only 8 million barrels are recoverable by primary means. Simplified computer models were used to predict the performance of in-situ combustion, polymer flooding, and steam flooding. Economic analyses were done on the results of these predictions and sensitivity studies were performed for various physical and economic parameters. This report provides a foundation of information, offers a template for economic decisions, and makes preliminary recommendations based on performance predictions. Before field-wide application of any project is undertaken, a better characterization of the reservoir must be accomplished and pilot projects evaluated. However, this analysis suggest that the most favorable application in the Shannon Sandstone is polymer flooding operated on 2.5-acre spacing. This technique is predicted to give a net present value of $5.43 million per 10-acre unit with a present value ration of 9.4 for its four year economic life.

10931 **(NIPER—B06717-1) Verti Jack Pumping Unit evaluation.** Porter, R.; Spence, K. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Nov 1985. Contract FG01-84CE15177. 47p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004948.

The Verti Jack Pumping Unit was tested primarily to establish the energy comsumption efficiency of the unit as compared with that of conventional pumping unit. Before the unit was field tested, extensive static testing was performed to determine the effect of the counterbalance system throughout the operational cycle. The field test included comparing the performance of the Verti Jack Unit and conventional pump jacks - a Bethlehem 16 and Cabot 25 pumping unit. The Verti Jack unit was operated at four different pumping conditions. The Verti Jack unit peformed satisfactorily during the testing. Only minor problems that could not be attributed to the design or operation of the unit were encountered. Changing the stroke length was difficult in the field, but such operational problems were expected in operating the first phototype and can be corrected on future models. During the higher pumping rate tests of the Verti Jack unit, the well ceased to deliver fluid quantities at rates adequate to the pumping rate. These data are shown in table 8. Therefore, evaluation data are based on theoretical pump performance and are presented in table 9. The data show that the Verti Jack is more efficient than the conventional units tested. The most direct comparison was the Verti Jack test at 36-inch stroke and 12 1/2 strokes per minute versus the Cabot unit at 37-inch stroke and 12 strokes per minute. In the comparison the Verti Jack operated about 24 percent more efficiently than the Cabot unit. Comparing the summation of all Verti Jack tests with that of all conventional unit tests, the Verti Jack operated about 15 percent

more efficiently. Compared to the Cabot unit only, the Verti Jack was about 17 percent more energy efficient. 13 figs., 12 tabs.

0204 Processing

REFER ALSO TO CITATION(S) 10841

0205 Products And By-products

REFER ALSO TO CITATION(S) 11150, 11603

0206 Health And Safety

REFER ALSO TO CITATION(S) 10919, 10954

10932 **Forecasting world oil prices: the evolution of modeling methodologies and summary of recent projections.** Curlee, T.R. (Oak Ridge National Lab., TN). *Materials and Society;* 9: No. 4, 413-442(1985).

This paper has three main objectives: (1) to review and summarize the varios methodologies that have been developed to explain historical oil price changes and forecast future price trends, (2) to summarize recent world oil price forecasts, and, when possible, discuss the methodologies used in formulating those forecasts, and (3) utilizing conclusions from the reviews of the modeling methodologies and the recent price forecasts, in combination with an assessment of recent and projected oil market trends, to give oil price projections for the time period 1987 to 2022. The paper argues that modeling methodologies have undergone significant evolution during the past decade as modelers increasingly recognize the complex and constantly changing structure of the world oil market. Unfortunately, a consensus about the appropriate methodology to use in formulating oil price forecasts is yet to be reached. There is, however, a general movement toward the opinion that both economic and political factors should be considered when making price projections. Likewise, there is no consensus about future oil price trends. Forecasts differ widely. However, in general, forecasts have been adjusted downwardly in recent years. Further, an overall assessment of the forecasts and recent oil market trends suggests that oil prices will remain constant in real terms for the remainder of the 1980s. Real oil prices are expected to increase by between 2 and 3% during the 1990s and beyond. Forecasters are quick to point out, however, that all forecasts are subject to significant uncertainty. 68 references, 1 figure, 6 tables.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 10841, 11136, 11398

10933 **(DOE/EIA—0035(85/09)) Monthly Energy Review, September 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 23 Dec 1985. 132p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE86004521.

The Monthly Energy Review presents current data on production, consumption, stocks, imports, exports, and prices of the principal energy commodities in the United States. Also included are data on international production of crude oil, consumption of petroleum products, petroleum stocks, and production of electricity from nuclear-powered facilities.

10934 **(DOE/EIA—0109(85/10)) Petroleum Supply Monthly, October 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 24 Dec 1985. 97p. NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. File Number DE86004541.

Detailed statistics are provided for crude oil, petroleum products, fuel oil supply and disposition for November and October 1985. Refinery operations, imports and exports, transportation, and sulfur content of heavy fuel oil are provided for October 1985. (PSB)

10935 **(DOE/EIA—0208(86-02)) Weekly Petroleum Status Report. Data for week ended: January 3, 1986.** (USDOE Energy Information Administration, Washington, DC). 8 Jan 1986. 35p. NTIS, PC A03/MF A01; 1 - GPO; GPO Dep. File Number DE86005126.

The Weekly Petroleum Status Report (WPSR) provides timely information on the pertroleum situation in the context of the historical information, selected prices, and forecasts. The WPSR is intended to provide up-to-date information to the industry, the press, planners, policymakers, consumers, analysts, and State and local governments. It is published each Thursday by the Energy Information Administration based on company submissions for the week ending 7 a.m. the preceding Friday. This publication is available on an annual subscription basis from the Superintendent of Documents, US Government Printing Office (GPO). Ordering information and purchase of this and other EIA publications may be obtained from the GPO or the EIA's National Energy Information Center (NEIC).

10936 **Price controls, price dispersion, and the supply of refined petroleum products.** Agarwal, V.B.; Deacon, R.T. (Old Dominion Univ., Norfolk, VA). *Energy Economics;* 7: No. 4, 210-219(Oct 1985).

The paper analyzes the petroleum-industry price and allocation controls that dominated US energy policy during the 1970s. It is emphasized that since controls on refined products tied maximum prices to costs of production, the market effects of this regulatory system were quite unusual. The paper shows that controls induced firms to price refined products below marginal costs. In addition, the regulations tended to increase the degree of dispersion in prices charged by firms in the industry. Finally, in the context of multiple-product analysis, it is shown that the presence of effective ceiling prices for any of the products reduced the prices of all products below marginal costs. 13 references, 4 figures, 2 tables.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 10807, 10964

10937 **(EGG—10282-2082) Hematologic values of the endangered San Joaquin kit fox, Vulpes macrotis mutica.** McCue, P.M.; O'Farrell, T.P. (EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations). Jan 1986. Contract AC08-83NV10282. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005098.

Between 1981 and 1982 a total of 102 blood samples was collected from 91 San Joaquin kit foxes, Vulpes macrotis mutica, won the US Department of Energy's Naval Petroleum Reserve No. 1 (Elk Hills), in western Kern County, California. The goal of the study was to establish normal blood parameters for this endangered species and to determine whether changes in them could be used to assess the possible effects of petroleum developments on foxes. Adult foxes had the following average hematological characteristics: RBC, 8.4 x 10^6 cells/μl; Hb, 14.9 g/dl; PCV, 46.9%; MCV, 56.4 fl; MCH, 18.2 pg; MCHC, 32.0 g/dl; and WBC, 6900/μl. None of the parameters differed significantly between the sexes. RBC, Hb, PCV, MCV, and MCHC varied as a function of age for puppies between three and six months of age. The highest values of MCV and MCH were obtained in summer, 1982, and the highest value of MCHC was obtained in winter, 1981-1982. These were the only parameters that appeared to change with season. None of the blood parameters appeared to be affected by petroleum developments. Hematological data for kit foxes, coyotes, and wolves confirmed a previously published observation that within mammalian families RBC is inversely correlated with body weight, and that MCV is directly correlated with body weight. It was speculated that it was an adaptive advantage for kit foxes having a high weight-specific metabolic rate to have evolved a high RBC and low MCV, allowing increased oxygen transport and exchange, while PCV was maintained relatively constant, avoiding hemoconcentration and increased viscosity of blood. 33 refs., 1 fig., 6 tabs.

10938 **(OCS/EIS/EA/MMS—85-0085-Vol.1) Final environmental impact statement: proposed Norton Basin Lease Sale 100. Volume 1.** (Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region). Dec 1985. 607p. USDI - Minerals Management Service, 12203 Sunrise Valley Dr., Reston, VA 22091. File Number TI86900378.

The leasing proposal consists of 3.96 million hectares (approximately 9.8 million acres) of Outer Continental Shelf (OCS) lands. The 1755 blocks are located in the Norton Basin Planning Area in waters that are from about 5 to 130 kilometers (3 to 81 miles) offshore. The mean economically recoverable resources unleased in the area are estimated to be 282 million barrels of oil and 1552 billion cubic feet of gas with a marginal probability of 0.12 for hydrocarbons. If implemented, this lease sale is tentatively scheduled to be held in March 1986. Oil and gas activities on all blocks offered pose some degree of pollution risk to the environment if leased, explored, and developed. The risk is related to adverse effects on the environment and other resource uses that may result from accidental or chronic oil spills. Socioeconomic effects from onshore development could have state, regional, and/or local implications. Several alternatives and mitigating measures may be applied which may reduce the type, occurrence, and extent of adverse effects associated with this proposal. Other measures, which are beyond the authority of this agency to apply, have also been identified. In spite of mitigating measures, some effects are considered unavoidable. For instance, if oil were discovered and produced, oil spills would be statistically probable, there would be some disturbance to fishery and wildlife values, and some onshore development could occur in undeveloped and/or wilderness areas.

10939 **(PB—85-237246/XAB) Use of airborne microwave radiometry for the detection and investigation of oil slicks at sea.** Hurford, N. (Warren Spring Lab., Stevenage (UK)). 1985. 23p. (LR—505(OP)M). NTIS, PC A03/MF A01.

The principles underlying the detection of oil slicks by microwave radiometry are outlined and the results of tank trials and sea trials to assess radiometer performance are presented. The limitations of the technique in determining slick thickness are discussed and it is concluded that an operational system should only use the microwave technique in conjunction with other sensors.

10940 **(PB—85-237253/XAB) Framework for oil-spill response on the Alaskan OCS (Outer Continental Shelf).** Allen, G.H.; Hale, D.A.; Prentki, R.T. (Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region). 1984. 13p. (MMS/AK/TE—84-001). NTIS, PC A02/MF A01.

OCS Report 84-0021 is a compilation of mandated Federal regulations for those responsible for an oil spill on the Alaskan Outer Continental Shelf (OCS). It specifies lessee responsibilities for pollution prevention and control; requirements for inspections and reports, pollution-control materials and equipment, oil-spill-contingency plans, annual drills and the training of personnel. Industry oil-spill-response organizations are discussed as well the mechanism for industry contingency planning. Federal responsibilities for oil-spill response are delineated and the contact agencies are specified. The report concludes with a discussion of cleanup policies and techniques and a final section listing Federal funds available for compensation for oil-spill damage.

10941 **(PB—85-238079/XAB) Oil in the sea: inputs, fates, and effects. Final report.** (National Research Council, Washington, DC (USA)). Apr 1985. 621p. NTIS, PC A99/MF A01.

The report updates a 1975 Research Council study of the sources, fates, and effects of petroleum in the marine environment. The National Research Council committee found no irrevocable damage to marine resources on a broad oceanic scale as a result of oil pollution from either chronic, routine sources or from occasional major spills. It cautioned that further research is needed before an unequivocal assessment of the environmental impact of oil pollution can be made, particularly as it applies to specific locations and conditions. The most important sources of oil pollution in the world's seas, the committee concluded, are municipal and industrial runoff, the cleaning of ship bilges, and other routine occurrences rather than offshore oil production or tanker accidents.

10942 **(PB—85-239572/XAB) Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 27.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Dec 1984. 472p. NTIS, PC A20/MF A01.

A compilation of two final reports dealing with the fate and effects of drilling fluids and cuttings discharges in Cook Inlet and Georges Bank and a conceptual oil-dispersion model of lower Cook Inlet - Shelikof Strait.

10943 **(PB—85-239580/XAB) Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 28.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Dec 1984. 471p. NTIS, PC A20/MF A01.

A compilation of three final reports dealing with microbial processes as related to transport in the North Aleutian Shelf and St. George Basin; biodegradation of aromatic compounds by high-latitude phytoplankton; and an assessment of potential interactions of microorganisms and pollutants resulting from petroleum development on the Alaskan OCS.

10944 **(PB—85-239598/XAB) Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 29.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Jan 1985. 427p. NTIS, PC A19/MF A01.

This compilation of four final reports deals with sublethal effects of petroleum hydrocarbons and trace metals; the nature and biological effects of weathered petroleum; the effects of oiled sediment on juvenile king crab; and a review of the effects of petroleum hydrocarbons on Alaskan aquatic organisms.

10945 **(PB—85-244499/XAB) Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1980. Volume 6. Transport.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Mar 1980. 602p. NTIS, PC A99/MF A01.

The report is a compilation of 8 annual reports dealing with the interaction of oil with sea ice in the Arctic Ocean; dynamics of near-shore ice; current measurements in possible dispersal regions of the Beaufort Sea; Gulf of Alaska study of mesoscale oceanographic processes; and circulation and water masses in the Gulf of Alaska.

10946 **(PB—85-244507/XAB) Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1980. Volume 7. Transport data management.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Mar 1980. 688p. NTIS, PC A99/MF A01.

The study is a compilation of annual reports dealing with transport and data-management subjects. Transport reports include sediment dynamics in a northern Arctic lagoon, Prudhoe Bay diffusivity measurements, Bristol Bay oceanographic processes, Oil pooling under sea ice, and Transsport of oil under sea ice. Data-management reports include operation of an Alaskan facility for applications of remote sensed data.

10947 **(PB—85-244515/XAB) Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 3. Effects of contaminants.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Mar 1981. 527p. NTIS, PC A23/MF A01.

Volume 3 of the study is a single annual report which is: Multivariate Analysis of Petroleum Weathering in the Marine Environment-SubArctic.

10948 **(PB—85-244523/XAB) Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 4. Effects of contaminants.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Mar 1981. 677p. NTIS, PC A99/MF A01.

A compilation of 8 annual reports on the subjects of: assessment of potential interactions of microorganisms and pollutants, lethal and sublethal effects on selected species after acute and long-term exposure to oil, sublethal effects of petroleum hydrocarbons, Baffin Island oilspill experiment, chemistry component, effects of oil and dispersed oil on nearshore macrobenthos, microbial degradation of oil, and biodegradation of aromatic compounds by high-latitude phytoplankters.

10949 **(PB—85-244531/XAB) Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 5. Transport.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Mar 1981. 678p. NTIS, PC A99/MF A01.

A compilation of 8 annual reports on the following subjects: the interaction of oil with sea ice in the Arctic Ocean, circulation processes in Bristol Bay using dissolved methane as a tracer, modeling of tides and circulations of the Bering Sea, meteorology of the Alaskan arctic coast, nearshore hydrodynamics of the Beaufort and Chukchi seas; sources, transport pathways, depositional sites and dynamics of sediments in the lagoon and adjacent shallow marine region, northern Arctic Alaska; numerical trajectory modeling and associated field measurements in the Beaufort and Chukchi Sea nearshore areas, and fluid transport processes in the North Aleutian Shelf and St. George Basin.

10950 **(PB—85-244549/XAB) Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 6. Transport.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Mar 1981. 497p. NTIS, PC A21/MF A01.

This report is a compilation of 4 annual reports on the following subjects: Transport and behavior of oil spilled in and under sea ice; the North Aleutian Shelf Transport Experiment; Microbial Processes related to transport in the North Aleutian Shelf; and St. George Lease areas; and Coastal oceanography of the northeast Gulf of Alaska.

10951 **(PB—85-244556/XAB) Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 7. Hazards.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Mar 1981. 696p. NTIS, PC A99/MF A01.

This report is compilation of 9 annual reports on ice and geology: Seismotectonic analysis of seismic and volcanic hazards in the Pribilof Islands-Eastern Aleution Islands region; dynamics of near-shore ice; delineation and engineering characteristics of permafrost beneath the Beaufort Sea; offshore permafrost studies and shoreline history as an aid to predicting offshore permafrost conditions; seismic and volcanic risk studies; Western Gulf of Alaska; subsea permafrost probing; thermal regime; and data analysis.

10952 **(PB—85-244564/XAB) Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 8. Hazards and data management.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). Mar 1981. 725p. NTIS, PC A99/MF A01.

The study is a compilation of 4 reports dealing with environmental hazards and 6 reports dealing with data management. Hazards reports are: grain size and sediment composition on the Kodiak shelf; bottom sediment geotechnical characteristics in the northern Bering Sea; the offshore seismic-measurement program; and Beaufort and Chukchi Seacoast permafrost studies. Data management reports include remote-sensing facility, data-management support, and the quality assurance program for trace petroleum component analysis.

10953 **(PB—85-247260/XAB) Environmental assessment of the Alaskan Continental Shelf. Final reports of principal investigators. Volume 18. Biological studies.** (National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.). May 1983. 707p. NTIS, PC A99/MF A01.

A compilation of two final reports dealing with the evolution, pathobiology, and breeding ecology of large gulls (Larus) in the Northeast Gulf of Alaska and effects of petroleum exposure on the breeding ecology of gulls and kittiwakes, and bird use of coastal habitats in Norton Sound.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 10936

10954 **(PB—85-241164/XAB) Precautionary labeling of petroleum products in packages - a labeling system.** Stephens, R.W.; Allen, M.E.; Arscott, H.C.; Ebbon, G.P.; Eyres, A.R. (Concawe, The Hague (Netherlands)). 1985. 104p. (CONCAWE—1/85). NTIS, PC A06/MF A01.

The report contains a labeling system for packaged petroleum products based on that published in CONCAWE Report 2/80. The previous system has been modified to take account of the EEC Guide for labeling (Annex III of Directive 83/467/EEC). The system has been prepared as an aid to greater harmonization in the labeling of petroleum products throughout Europe, and to assist individual oil companies in meeting product liability requirements. It is primarily intended to conform with EEC concepts. However, if necessary, it can be adapted to meet prevailing local rules and regulations.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 11374

0240 Storage

10955 **(DOE/FE—0052) Strategic Petroleum Reserve: site expansion alternatives to the development of the Big Hill site.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Strategic Petroleum Reserve Program Office). Oct 1985. 112p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86005391.

This report evaluates the expansion of one or more existing Strategic Petroleum Reserve (SPR) storage sites as an alternative to the continuation of the development of the Big Hill, Texas, storage site. Three (3) alternatives are identified and compared to the current plan (Big Hill) in terms of cost, schedule and other factors; these alternatives are as follows: (1) expansion of the West Hackberry site by 140 million barrels; (2) expansion of the Weeks Island site by 140 million barrels; and (3) a multiple site expansion consisting of the Weeks Island site (100 MMB), the Bryan Mound site (20 MMB), the West Hackberry site (10 MMB), and the Bayou Choctaw site (10 MMB). In addition to expanding site storage capacity, each of the alternatives require further enhancements to site drawdown capability and off-site distribution capability in order to achieve the program drawdown and distribution requirements that would be satisfied by completing the Big Hill site.

10956 **(SAND—85-1326) Effective heat transfer in the Strategic Petroleum Reserve porous media.** Tomasko, D. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1985. Contract AC04-76DP00789. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004970.

The properties of saturated brine/anhydrite porous media at the bottom of the Strategic Petroleum Reserve (SPR) caverns are estimated from core and evaporation pond samples. The results of these analyses indicate that the Darcy-Rayleigh number for the porous media from a low of one to a high of 100 for SPR cavern conditions. Calculations for porous media enclosed by vertical walls having a linearly decreasing temperature profile indicate that the effective heat transfer is augmented by, at most, a factor of three above heat transfer by conduction across a stagnant fluid. This in-

crease in heat transfer has a negligible effect on SPR thermal calculations because of the dominance of wall heat transfer in the caverns. 17 refs., 22 figs., 3 tabs.

10957 **(SAND—85-2027) Field test of drag reducing agents in a three-inch pipeline at the West Hackberry, Louisiana SPR site.** Hinkebein, T.E. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1985. Contract AC04-76DP00789. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005106.

A flow test of seven drag reducing agents (DRAs) was carried out at the Strategic Petroleum Reserve (SPR) site at West Hackberry, Louisiana. A 3-inch pipeline was operated with DRA addition, at controlled concentrations, to flowing brine while the fluid flow rate and the pressure drop were continuously monitored. The fluid flow rates were controlled so that the wall shear stress in the 3-inch pipeline approximated the wall shear stress in the 36-inch brine disposal pipeline at the West Hackberry SPR site. Two classes of materials were tested: a guar and six polyacrylamide DRAs. These materials were tested at concentrations up to 19 parts per million (ppM). The polyacrylamide DRAs all have a higher level of activity than the guar, but demonstrate a susceptibility to pipe roughness that the guar did not. The six polyacrylamide DRAs showed maximum friction factor reductions at 19 ppM between 27% and 44%. The maximum friction factor reduction for the guar DRA was 9%. The performances of all DRAs were functions of concentration and were fit by a power law model. The performance of the polyacrylamides was proportional to approximately the 0.9 power of concentration while that of the guar was proportional to the 1.5 power. At the test flow condition, the improvement observed in these drag reduction experiments should be equivalent to flow improvement in the 36-inch pipeline. 4 refs., 10 figs., 8 tabs.

0250 Combustion

REFER ALSO TO CITATION(S) 10807, 10872, 10874, 10881

03 NATURAL GAS

0302 Geology And Exploration

10958 **(DOE/MC/21088—1964) Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report.** Brooks, J.M.; Bryant, W.R. (Texas A and M Univ., College Station (USA). Dept. of Oceanography). Sep 1985. Contract FG21-84MC21088. 137p. NTIS, PC A07/MF A01. File Number DE86001011.

This document presents the results of a study of the geological and geochemical implications of gas hydrates in the Gulf of Mexico. The report is based primarily on data obtained from available seismic surveys of the Green Canyon, Garden Banks, Mississippi Canyon, and Orca Basins areas of the northern continental margin of the Gulf of Mexico. The study also includes the data and analysis obtained from several gas hydrate cores recovered in these areas. The report provides new data relevant to gas hydrate research for more in-depth research of the Gulf of Mexico gas hydrates and provides significant information which advances the knowledge and understanding of gas hydrate formations in the natural environment. The report contains several high resolution seismic surveys. In the four hydrate sites studied in detail, the seismic "wipeout" zones were all associated with collapsed structures, fault scarps, and/or salt piercement structures. These features provide conduits for the upward migration of either biogenic or thermogenic gas from depth. 35 refs., 47 figs., 9 tabs.

0304 Products And By-products

REFER ALSO TO CITATION(S) 11150

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 11398

10959 **(BNL—37377) Modeling residential natural gas demand at the state level.** Minasi, M.J. (Brookhaven National Lab., Upton, NY (USA)). Aug 1984. Contract AC02-76CH00016. 7p. (CONF-840851—2). NTIS, PC A02. File Number DE86005247.

From 2. IMACS symposium on energy modeling and simulation; Upton, NY, USA (26 Aug 1984).

This paper describes a model of residential consumption of natural gas. The model is estimated with two different but parallel data sources: the Energy Information Administration's (EIA) new Energy Price and Expenditures Data System (EPEDS) and data published by the American Gas Association (AGA). These data are supplemented by data for explanatory variables, which are described in the text. 22 refs., 2 tabs.

10960 **(BNL—37399) SIMBID: An alternative, simplified model of bidding and awarding of new natural gas reserves.** Kydes, A.S.; Wing, B.J. (Brookhaven National Lab., Upton, NY (USA)). Aug 1984. Contract AC02-76CH00016. 6p. (CONF-840851—3). NTIS, PC A02. File Number DE86005248.

From 2. IMACS symposium on energy modeling and simulation; Upton, NY, USA (26 Aug 1984).

The main purpose of this paper is to provide an overview of the SIMBID methodology which develops demands for new natural gas reserves - one possible alternative to the dynamic programming formulation incorporated in the Gas Analysis Modeling System (GAMS). The demand curves are derived for each pipeline system based on, among other things, the "expected" price of the principal competing fuel for each pipeline system, the "expected" demand in the next few years for each pipeline system, the deliverability for the pipeline's controlled gas reserves and other contractual obligations. Several illustrations of the SIMBID model behavior within GAMS are also provided. SIMBID has produced results similar to the current model, using the same set of exogenous assumptions, with a more than 50% reduction in computer time for the bidding component of GAMS. This is due to the simplification of the SIMBID algorithm and reduced demands on other components of the GAMS. 3 refs., 1 tab.

10961 **(DOE/EIA—0130(85/10)) Natural Gas Monthly, October 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 19 Dec 1985. 142p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE86004522.

Current data on natural and supplemental gas consumption, disposition, production, prices, storage, imports, and exports in the United States are provided for each year from 1980 through 1985 with monthly data for the most recent 3 years. Some data are also given by state or city; some data are also given for previous years. Operating and financial data for major interstate natural gas pipeline companies, as well as data on filings, ceiling prices, and transportation under the Natural Gas Policy Act of 1978, are also included. Explanatory notes, a discussion of data sources, and a glossary are included. Three reports previously published as separate annuals are now published in this report. The three are: "Underground Natural Gas Storage in the United States" (DOE/EIA—0239); "US Imports and Exports of Natural Gas" (DOE/EIA—0188); and "Main Line Sales of Natural Gas to Industrial Users" (DOE/EIA—0129). 6 figs., 34 tabs.

10962 **(DOE/EIA—0131(84)/1) Natural Gas Annual, 1984. Volume I.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 31 Dec 1985. 261p. NTIS, PC A12/MF A01; 1 - GPO; GPO Dep. File Number DE86005110.

This publication provides information on the production, reserves, imports, exports, interstate movements, storage, consumption, and price of natural gas to a wide audience including industry, consumers, Government agencies, and educational institutions. The data in the 1984 Annual are presented in a sequence that follows natural gas (including supplemental supplies) from production to end use. Annual summary data on the quantity and average price of natural gas production at the state and national levels are presented, as well as total gas supply/disposition balances. Data on the quantity and price of natural gas consumption are shown for major end-use categories by state. Historical data are then shown in the same sequence.

10963 **(DOE/EIA—0131(84)/2) Natural Gas Annual 1984. Volume II.** Maupin, E.H. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 31 Dec 1985. 263p. NTIS, PC A12/MF A01; 1 - GPO; GPO Dep. File Number DE86005111.

This publication provides information on deliveries of natural gas to large end users by Standard Industrial Classification (SIC) code for 5 heating years from 1980-1981 through 1985-1985. Tables are presented showing deliveries of natural gas: (1) to the top 20 industries; (2) to large end users by SIC; (3) by the top 100 distributors; (4) to large end users by industry and state; and (5) to large end users by state. 5 figs., 5 tabs.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 10938

10964 **(OCS/EIS/MMS—85-0086) Final environmental impact statement: proposed central Gulf of Mexico OCS Lease Sale 104 (April 1986) and proposed western Gulf of Mexico OCS Lease Sale 105 (July 1986).** (Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Region). Nov 1985. 699p. Minerals Management Service, Box 7944, Metairie, LA 70010. File Number TI86900233.

The proposed action for Sale 105 (July 1986) will offer for lease all unleased acreage in the Western Planning Area (WPA) with the exception of the administratively deferred areas described below. The unleased area available for leasing in the WPA amounts to approximately 27.1 million acres on 4879 blocks as of September 1985 (Figure I-1). Unleased blocks are located from approximately 9-222 miles offshore in water depths ranging from approximately 8 m to over 3000 m. Deferred from Sale 105 are Blocks A-375 (East Flower Garden Bank) and A-398 (West Flower Garden Bank) in High Island Area, East Addition, South Extension and 123 blocks located in South Padre Island Area and South Padre Island Area, East Addition along the provisional United States maritime boundary with Mexico. The biological, archaeological resources, and military areas stipulations for the two planning areas are included as part of the proposed actions as committed mitigating measures for both Sales 104 and 105. The proposed actions are discussed as Alternative A in Sections II and IV of this EIS. The proposed sale areas and deferrals are shown in Figure I-1. Depiction of areas under lease as of October 12, 1984, are shown on Visual No. 1, Historic Leasing. Basic assumptions, estimates, and development scenarios for impact analyses of the proposed actions are presented in Section IV.A. Four development scenarios for each proposed action provide a quantitative and locational framework for the impact analyses. The Most Likely Find Scenarios (M Scenario) are the focus of the impact analyses for the proposed sales and alternatives and are also used along with other impact producing factors in the cumulative analyses (Section IV.D.). Low, High, and Total Find Scenarios were also used in supplemental analyses for comparative purposes (Sections IV.D.1.d. and IV.D.2.d.). Table S-1 provides resource and offshore infrastructure estimates for each scenario.

0309 Artificial Stimulation

10965 **(DOE/MC/21119—T4) Stimulation model for lenticular sands: Proppant transport model. Phase I annual report. Final report.** Rybicki, E.F.; Sutrick, J.S. (Tulsa Univ., OK (USA). Dept. of Mechanical Engineering). 1986. Contract AC21-84MC21119. 158p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86004633.

The University of Tulsa and NIPER are jointly involved in developing a computational model to represent hydraulic fracturing in western gas sands. The approach to developing the model is to modify and combine two existing computational models. One model is a fracture geometry model that has been developed at NIPER. The other model is a proppant transport model which has been developed at The University of Tulsa. The research is a three year project. This report describes the first year's effort of the program with the focus on the proppant transport model at The University of Tulsa. The University of Tulsa proppant transport model can handle either Newtonian or non-Newtonian fluid behavior and can represent a number of different pumping rates and proppant types. The proppant transport section of the model contains a library of five settling models from which the user can select one. The proppant transport model can calculate proppant distributions at the end of the proppant pumping schedule. The model has an elaborate tracking system to account for all of the proppant particles. Accomplishments this year include work toward modifying the proppant transport model to handle the fracture geometry from the NIPER fracture model. Plans for meeting the goal of combining the fracture geometry model and the proppant transport model into a single interactive computational model are described. A new proppant settling model was developed during this year. The model meets all of the five criteria defined for a useful proppant settling model. Other efforts during this year include verification of the proppant transport model through comparisons of solutions with published proppant transport models. 65 refs., 37 figs., 6 tabs.

0330 Properties

10966 **Vapor spill monitoring method.** Bianchini, G. M.; McRae, T. G. (to The United States of America as represented by the United States Department of Energy). US Patent 4,535,639. 20 Aug 1985. Filed date 23 Jun 1983. vp. PAT-APPL-507188.

Method for continuous sampling of liquified natural gas effluent from a spill pipe, vaporizing the cold liquified natural gas, and feeding the vaporized gas into an infrared detector to measure the gas composition. The apparatus utilizes a probe having an inner channel for receiving samples of liquified natural gas and a surrounding water jacket through which warm water is flowed to flash vaporize the liquified natural gas.

0340 Combustion

REFER ALSO TO CITATION(S) 10887

04 OIL SHALES AND TAR SANDS

0404 Oil Production, Recovery, And Refining

10967 **(DOE/FE/60177—1993) Extraction of Green River and Chattanooga oil shales with strong bases and nucleophilic displacement reagents.** Robertson, R.E.; Holmes, S.A. (Western Research Inst., Laramie, WY (USA)). Oct 1985. Contract FC21-83FE60177. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004933.

Shale kerogen has been degraded to an organic solvent-soluble bitumen or oil by numerous methods. The various methods have been employed either to study production of oil or to gain insight into the structure of kerogen. The purpose of this investigation was to gain insight on kerogen structure by examination of the effects of strong base and nucleophilic displacement reagents on western and eastern shales. Powdered shales from the Green River

and Chattanooga formations were extracted with potassium hydroxide in 1-propanol, potassium hydroxide in 1-butanol, 1-butylamine in 1-butanol, and sodium borohydride in tetrahydrofuran, all at reflux. Residual shales were extracted with benzene-methanol. The products were isolated and weighed in an effort to find a system that would degrade the kerogen to a soluble bitumen under basic, solvolytic conditions. The extraction of Green River shale with potassium hydroxide in 1-butanol gave the highest conversion (40.2 wt %) of organic carbon. The solutions containing butylamine and sodium borohydride gave small yields of product. The results from extraction of Chattanooga shale showed approximately 20% conversion with potassium hydroxide in 1-butanol while all other systems exhibited very small conversions. 21 refs., 4 tabs.

10968 **(PB—85-246965/XAB) Alkaline and Stretford scrubbing tests for H_2S removal from in-situ oil retort offgas. Final report, February 1983-February 1985.** Taback, H.J.; Quartucy, G.C.; Goldstick, R.J. (Metcalf and Eddy, Inc., Wakefield, MA (USA)). Jun 1985. 234p. NTIS, PC A11/MF A01.

The report gives results of an evaluation of two mobile pilot-plant scrubbers (one alkaline, the other Stretford) for removing reduced sulfur compounds from the offgas of an in-situ retort at Geokinetics. The alkaline scrubber had a tray tower and a venturi contactor used alternately with NaOH, KOH, and NH4OH to investigate the effects of scrubbing chemical, chemical concentration, and residence time on removal efficiency and H_2S selectivity. The Stretford plant employed a venturi contactor (near the end of the test, a packed-tower contactor was added downstream of the venturi). A computer model of the alkaline scrubber, based on the penetration theory, was developed and agrees well with the observed performance. Based on this model, it appears possible to design an alkaline scrubber system that can achieve 95% H_2S removal at a selectivity of 37.

10969 **(PNL—5658) Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort.** Olsen, K.B.; Evans, J.C.; Sklarew, D.S.; Girvin, D.C.; Nelson, C.L.; Lepel, E.A.; Robertson, D.E.; Sanders, R.W. (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 55p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86005492.

The objective of this program is to determine how retorting process parameters affect the partitioning of Hg, As, Se, and Cd from raw oil shale to spent shale, shale oil, retort water, and offgas. For each of the elements, the objective of this study is to (1) determine the distribution coefficients for each product stream; (2) identify the chemical forms in water, gas, and oil streams, with particular emphasis on inorganic or organometallic species known to be or suspected of being carcinogenic, toxic, or otherwise harmful; (3) investigate the mechanism(s) responsible for mobilization into each product stream for toxic or labile chemical forms identified in item 2 are mobilized into each product stream; and (4) the effect of retorting rate, maximum retorting temperature, and retorting atmosphere on items 1 and 3. A Green River shale from Colorado and a New Albany shale from Kentucky were heated at 1 to 2°C/min and at 10°C/min to maximum temperatures of 500 and 750°C under a nitrogen sweep gas. The product streams were analyzed using a variety of methods including Zeeman atomic absorption spectroscopy, microwave-induced helium plasma spectroscopy, x-ray fluorescence, instrumental neutron activation analysis, high-pressure liquid and silica gel column chromatography, and mercury cold vapor atomic absorption. The results obtained using these analytical methods indicate that the distribution of mercury, arsenic, and selenium in the product stream is a function of oil shale type, heating rates, and maximum retorting temperatures. 11 refs., 27 figs., 5 tabs.

10970 **(UCRL—53609) Operating experience with the Livermore solid-recycle retort system.** Mallon, R.G. (Lawrence Livermore National Lab., CA (USA)). Feb 1985. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005291.

Seven runs in a series of experiments to study the behavior of solid-recycle systems for oil shale retorting have been completed at the Lawrence Livermore National Laboratory. Two of these runs failed because of mechanical problems, but the other five succeeded in yielding useful data. By operating the small-scale recycle system described herein, we were able to produce an oil yield equal to Fischer assay and to gain valuable information about pressures, temperatures, and flow rates. We also learned that pyrolysis gas has a low concentration of sulfur-containing compounds, none of which is detectable in the combustion gas. 3 refs., 15 figs., 8 tabs.

10971 **Characterization of a non-uniform retort using tracer techniques.** Romero, C.A.; Uhl, J.E. (Sandia National Laboratories, Albuquerque, NM). *In Situ;* No. 4, 369-399(1984).

Results from an extensive series of tracer tests conducted by Sandia National Laboratories (Sandia) in conjunction with the Wyoming Research Institute (WRI) are presented. Sandia injected tracer gases into a large experimental retort filled with crushed and screened raw oil shale. The resulting data were used to study the feasibility of the use of gaseous tracers to predict retort sweep efficiency in modified in situ (MIS) oil shale retorts. The effect of an impermeable cylindrical obstruction within the rubble on the resulting tracer signals was quantified. In addition to the tracer tests, thermal data were obtained from a steam front passed through the retort. This paper discusses the repeatability of the tracer data and methods of data analysis. Comparisons are made between results from the steam test and from the tracer tests.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 10969

0406 Direct Uses And By-products

REFER ALSO TO CITATION(S) 11603

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 10969

05 NUCLEAR FUELS

0501 Reserves

10972 (GSCan-P—85-1A, pp 15-22) **Summary on uranium in Canada, 1984.** Ruzicka, V.; LeCheminant, G.M. 1985. NTIS (US Sales Only), PC A99/MF A01. File Number DE86780328.

In Current research.

Field and laboratory investigations of recently discovered uranium occurrences and deposits have revealed that (a) the mineralization processes that formed the Cigar Lake deposit, Saskatchewan were similar to those reported for the McClean Lake deposit; (b) the recently discovered Boomerang Lake occurrence related to the sub-Thelon unconformity occurs in a geological environment similar to that hosting deposits related to the sub-Athabasca unconformity; (c) additional occurrences of mineralization similar to the Black Sturgeon Lake showing, Ontario, will be restricted to areas containing uraniferous igneous rocks adjacent to ferruginous metavolcanic rocks in areas affected by Keweenawan hydrothermal activity; (d) uranium occurrences in the Otish Basin, Labrador Trough, Central Mineral Belt of Labrador and the Nonacho Basin were formed by epigenetic processes.

10973 (GSCan-P—85-1A, pp 47-64) **Petrography, petrochemistry and mineral associations of selected rocks and radioactive occurrences north of Mont-Laurier, Quebec. A progress report.** Rimsaite, J. 1985. NTIS (US Sales Only), PC A99/MF A01. File Number DE86780328.

In Current research.

This paper documents additional results of laboratory studies, including SEM-EDS and isotope analyses, and discusses mineral associations in the following: 1. selected mafic, felsic, hybrid and

ore grade rocks; 2. mineralized gneissic and white heterogenous pegmatites; 3. mineralized pegmatites associated with quartzite and with pyrite-bearing biotite gneisses; 4. mineralized migmatites associated with microcline pegmatites; 5. pegmatites associated with mafic skarn and biotite gneisses. Mineralization occurs in primary and secondary minerals. Uranium mineralization occurs in contact zones between microcline pegmatite and paragneisses, as well as between paleosome and neosome phases. Radioactive REE-bearing occurrences are common at contacts between the pegmatite and mafic skarn.

10974 **(GSCan-P—85-1A) Current research.** (Geological Survey of Canada, Ottawa, Ontario). 1985. 816p. NTIS (US Sales Only), PC A99/MF A01. File Number DE86780328.
Individual papers were indexed separately.

0502 Exploration

REFER ALSO TO CITATION(S) 10974

10975 (GSCan-P—85-1A, pp 145-149) **Uranium in the Circum-Ungava belt, northern Quebec and Labrador. New information form the central Labrador Trough.** Bell, R.T.; Ruzicka, V. (Geological Survey of Canada, Ottawa, Ontario). 1985. NTIS (US Sales Only), PC A99/MF A01. File Number DE86780328.
In Current research.
Uranium occurs in several environments in the Circum-Ungava Belt. Newly recognized styles of mineralization in the Labrador Trough include occurrences hosted by black, cherty, and phosphatic shale and by dolostone. An additional occurrence in albitized rocks is documented. In general there are potential sources for uranium within clastic rocks, particularly in black shales, potential sources for scavenging agents in sequences containing evaporites, and appropriate thermal agencies and structural traps provided by widespread volcanism and attendant intrusions. Together these provide excellent conditions to form high-grade vein deposits in albitites within the Circum-Ungava Belt.

0503 Mining

REFER ALSO TO CITATION(S) 11077

10976 **(INFO—0130) Membrane barriers for radon gas flow restrictions.** Archibald, J.F. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Aug 1984. 49p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700488.
Research was performed to assess the feasibility of barrier membrane substances, for use within mining or associated high risk environments, in restricting the diffusion transport of radon gas quantities. Specific tests were conducted to determine permeability parameters of a variety of membrane materials with reference to radon flow capabilities. Tests were conducted both within laboratory and in-situ emanation environments where concentrations and diffusion flows of radon gas were known to exist. Equilibrium radon gas concentrations were monitored in initially radon-free chambers adjacent to gas sources, but separated by specified membrane substances. Membrane barrier effectiveness was demonstrated to result in reduced emanation concentrations of radon gas within the sampling chamber atmosphere. Minimum gas concentrations were evidenced where the barrier membrane material was shown to exhibit lowest radon permeability characteristics.

10977 **(INFO—0145) Computer modelling of an underground mine ventilation system.** (Senes Consultants, Willowdale, Ontario (Canada); Atomic Energy Control Board, Ottawa, Ontario (Canada)). Dec 1984. 195p. NTIS (US Sales Only), PC A09/MF A01. File Number DE86700489.
FORTRAN codes.
The ability to control workplace short-lived radon daughter concentrations to appropriate levels is crucial to the underground mining of uranium ores. Recognizing that mine ventilation models can be used to design ventilation facilities in new mines and to evaluate proposed ventilation changes in existing mines the Atomic Energy Control Board (AECB) initiated this study to first investigate existing mine ventilation models and then develop a suitable model for use by AECB staff. At the start of the study, available literature on mine ventilation models, in partiuclar models suitable for the unique task of predicting radon daughter levels, were reviewed. While the details of the models were varied, it was found that the basic calculation procedures used by the various models were similar. Consequently, a model developed at Queen's University that not only already incorporated most of the desired features but was also readily available, was selected for implementation. Subsequently, the Queen's computer program (actually two programs, one for mine ventilation and one to calculate radon daughter levels) was extended and tested. The following report provides the relevant documentation for setting up and running the models. The mathematical basis of the calculational procedures used in the models are also described.

0504 Feed Processing

REFER ALSO TO CITATION(S) 11099

10978 **(AECL—8256) Large-scale electrolytic reduction of U(VI) to U(IV).** Miller, F.C.; Hildebrandt, B.W.; Cassidy, R.M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Feb 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700472.
A step in the production of homogenous powders of $(Th-U)O_2$ is coprecipitation of U(IV) and Th(IV) with oxalic acid. This report describes the results of an investigation of the large-scale electrolytic reduction of uranium to U(IV). It was found that with the addition of 0.2 $mol.L^{-1}$ of hydrazine as a holding reductant and the use of a platinum gauze working electrode with a large surface area, 300 g batches of uranium could be reduced to >99.5 percent U(IV) in 800 min. The effects of a number of experimental parameters on the reduction process, and the stability of U(IV) solutions are discussed.

0505 Enrichment

REFER ALSO TO CITATION(S) 11070

10979 **(K/OA—5951) Computer extended asymptotic series for the two-dimensional linear hydrodynamics of a gas centrifuge with sources and sinks.** Berger, M.H. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jul 1985. Contract AC05-84OT21400. 33p. NTIS, PC A03. File Number DE86004932.
We have reformulated the general problem of internal flow in a modern, high-speed gas centrifuge with sources and sinks in such a way as to obtain new simple yet rigorous closed form, analytical solutions. Both symmetric and anti-symmetric drives lead to an ode in place of the usual inhomogeneous Onsager pde. Due to the difficulties of exactly solving this sixth order, inhomogeneous, variable coefficient ode, we appeal to the power of perturbation theory and techniques. Two extreme parameter regimes are easily identifiable, the so-called semi-long bowl and short bowl approximations. However, this paper treats only the former class of problems. It is shown that the long bowl solution for axial drive is the correct leading order terms, just like was found for pure thermal drive. New O(1) results are derived for radial, drag and heat drives in 2-D. Then we formally carry out regular asymptotic, even ordered power series expansions for the flow field to $O(\epsilon^4)$ on the computer so that our approximations are valid for values of ϵ near unity. In the spirit of Van Dyke one could carry out this expansion process, in theory, to apparently arbitrary order to describe the internal flow for arbitrary but finite decay length ratio. Evidently for asymptotically large x^* the flow induced by axial and radial forces are proportional. The corresponding separation theory integral parameters are given in a companion paper.

10980 **(LA-tr—85-36) Uranium isotope separation by magnetic field gradient and visible light acting in a liquid medium.** Borges, O.N. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. Translation source information not available . 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005002.

The literature shows that excited uranyl can assume the "singlet" and "triplet" states, with different magnetic properties. In an aqueous medium, without organic complexity (to hamper dismutation), the action of light reduces uranyl to U(V), which is a radical -ion that can assume the "doublet" and "quartet" states, also with different magnetic properties. Due to the different constants of velocity of uranium 235 and 238 in the reduction of excited uranyl and in the oxidation of U(V) to UO_2^{2+}, there is the probability of forming an isotopic gradient, in the aqueous solution, subjected to a magnetic field gradient, with consequent appropriate extraction. 6 refs.

10981 **A new era in U.S. uranium enrichment.** Longenecker, J.R. (U.S. Dept. of Energy, Washington, DC). *Nuclear Materials Management;* **13**: 1-3(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Complex market conditions, including lower than anticipated electrical growth rates, creation of a large spot market of enriched uranium, fluctuations in currency exchange rates, and certain political considerations, have created an unstable market for all primary producers, including the United States. In response to these conditions, the Department of Energy made significant changes to the U.S. program including the issuance of the Utility Services contract on January 18, 1984. Other major changes include redirecting research and development efforts on the advanced gas centrifuge and atomic vapor laser isotope separation processes, rescoping of the Gas Centrifuge Enrichment Plant project, and reevaluation of the operational mode of the three gaseous diffusion plants. Taken together, we believe these actions will retain the U.S. position of leadership in uranium enrichment. In summary, we plan to compete--through introduction of the world's most advanced, lowest cost technology and through responsiveness to our customers' needs.

10982 **Results from the study of UF_6 consumption on centrifuge process piping and its influence on gamma ray measurements.** Cooley, J.N.; Close, D.A.; Fields, L.W.; Hughes, M.R.; Nolan, T.A.; Pratt, J.C.; Strittmatter, R.B.; Swindle, D.W. (Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee). *Nuclear Materials Management;* **13**: 174-177(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

A gamma ray measurement technique for confirming the absence of highly enriched uranium (HEU) in process gas of gas centrifuge enrichment plants has been developed. This measurement technique is complicated by the presence of uranium deposits on the interior walls of the process pipes. The measurement approach is described, the mechanisms for deposit are discussed, and test results for quantifying the uranium in the deposits are reported. Based on observed U.S. plant operating conditions, the absence of HEU in the process gas can be confirmed with a 5-min gamma ray measurement.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 11019, 11021, 11022, 11087, 11606

10983 **(CEA-CONF—7686) Behaviour of palladium in the Purex process.** Vialard, E.; Germain, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Nov 1984. 13p. (CONF-8411189—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750388.

From Symposium on liquid-liquid extraction science; Dounreay, UK (27 Nov 1984).

Palladium is an abundant fission product but a minor radioactive contaminant of nuclear fuels. Its peculiar chemical behaviour is troublesome because it reacts with most of the reagents used in partition and forms insoluble compounds or cruds. Fortunately palladium extraction by 30% TBP-dodecane is moderate and high DF are excepted as long as the diluent is not excessively degraded. However, γ irradiated diluents display strong complexing power for palladium and retention of this element is observed.

10984 **(CEA-CONF—7772) Chemical properties of neptunium applied to neptunium management in extraction cycles of Purex process.** Guillaume, B.; Maurice, C.; Moulin, J.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); Air Force Air Materiel Command, Wright-Patterson AFB, OH (USA). Air Installations Div.). Nov 1984. 15p. (CONF-8411189—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750387.

From Symposium on liquid-liquid extraction science; Dounreay, UK (27 Nov 1984).

Alternative ways of managing neptunium in the Purex process are discussed. Main coordination and redox properties of neptunium in nitric medium are reviewed. Kinetics results with reagents consistent with "salt free process" are presented with emphasis on the influence of uranium and plutonium ions, including results about some peculiar behaviour of neptunium in TBP (the so-called cation-cation complexes). Attempts to fit chemical engineering models to neptunium metabolism in extraction equipment (mixer-settlers and pulsed columns) are described.

10985 **(CEA-CONF—7831) French experience and prospects in the reprocessing of fast breeder reactor fuels.** Megy, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Jun 1983. 19p. (In French). (CONF-8305291—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750324.

From AIF-FORATOM - internatioanl conference on fuel cycle; Geneva, Switzerland (31 May 1983).

Experience acquired in France in the field of reprocessing spent fuels from fast breeder reactors is recalled. Emphasis is put on characteristics and quantities of spent fuels reprocessed in La Hague and Marcoule facilities. Then reprocessing developments with the realisation of the new pilot plant TOR at Marcoule, new equipments and study of industrial reprocessing units are reviewed.

10986 **(CEA-CONF—7832) Spent fuel reprocessing past experience and future prospects.** Megy, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Sep 1983. 23p. (In French). (CONF-830948—2; IAEA-SR—87). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750323.

From Seminar on technical and environmental aspects of spent fuel management; Madrid, Spain (26 Sep 1983).

A large experience has been gathered from the early fifties till now in the field of spent fuel reprocessing. As the main efforts in the world have been made for developing the reactors and the fuel fabrication industry to feed them, the spent fuel reprocessing activities came later and have not yet reached the industrial maturity existing today for plants such as PWRs. But in the principal nuclear countries spent fuel reprocessing is today considered as a necessity with two simultaneous targets: 1. Recovering the valuable materials, uranium and plutonium. 2. Conditioning the radioactive wastes to ensure safe definitive storage. The paper reviews the main steps: 1. Reprocessing for thermal reactor fuels: large plants are already operating or in construction, but in parallel a large effort of R and D is still underway for improvements. 2. The development of fast breeder plants implies associated fuel reprocessing facilities: pilot plants have demonstrated the closing of the cycle. The main difficulties encountered will be examined and particularly the importance of taking into account the problems of effluents processing and wastes storage.

10987 **(CEA-CONF—7833) Five years experience of pulse columns extraction cycles for the reprocessing of fast breeder reactor fuels at the Marcoule pilot plant (SAP).** Charvillat; Fabre; Le Bouhellec; Henry. (CEA Etablissement de la Vallee du Rhone, 30 - Bagnols-sur-Ceze (France)). Nov 1984. 20p. (CONF-8411189—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750322.

From Symposium on liquid-liquid extraction science; Dounreay, UK (27 Nov 1984).

The reprocessing of Phenix fast breeder reactor started at the Marcoule Pilot Plant in 1977 with the enriched UO_2 first core (2.3 tons U) followed by several campaigns of UO_2-PuO_2 Phenix-core II (6.5 tons U-Pu). After a short description of the Pilot Plant, characteristics of the pulse columns extraction flow-sheets are presented. Pulse columns are used for extraction and scrubbing of uranium and plutonium and for uranium backwashing whilst plutonium stripping and U-Pu partition are carried out in mixer settlers with HAN and in-line electrolytic U IV generation. Performances of pulsed columns including recovery yields and decontamination factors are discussed: they show a good β γ decontamination can be reached with two cycles and partition carried out at the second cycle.

10988 **(ORNL/TM—9755) Assessment of photochemical applications to specific stages in Savannah River Plant actinide reprocessing streams.** Toth, L.M.; Bell, J.T.; Mailen, J.C.; Dodson, K.E. (Oak Ridge National Lab., TN (USA)). Jan 1986. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005371.

The application of photochemical redox methods has been evaluated as a means of separating actinides in Purex reprocessing streams. This chemistry promises to eliminate many of the chemical reagents which are otherwise necessary to effect valence control of such actinides as plutonium and neptunium. The most promising processing stages of the Savannah River Plant reprocessing facility for feasibility testing of the photochemical method appear to be those in which the concentrations of the actinides in question are the lowest, thus minimizing the required amount of absorbed light. Although neptunium valence control appears to be feasible through the photochemical generation of nitrite ion, the urgency for its control is secondary to that of plutonium. Therefore, the Purex "2nd-U-cycle feed" stage has been selected as the top priority for testing the photochemical technique. The chemistry initially involves the photoreduction of U(VI) to U(IV), which in turn reduces Pu(IV) to Pu(III). The results of preliminary experiments on nitrate ion and uranyl ion photoreduction are also given. With less than 100 W of absorbed power, the rates of NO_3^- and U^{4+} generation, respectively, appear ample to handle process requirements. 14 refs., 3 figs., 5 tabs.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 11079, 11083, 11085, 11746

10989 **(DOE/NV/10250—23) Commercial Nuclear Waste Research and Development Program. Annual report, fiscal year 1985.** (Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.). Dec 1985. Contract AC08-82NV10250. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005033.

Nuclear waste handling, packaging, and dry storage testing for the Department of Energy (DOE) Commercial Nuclear Waste Research and Development Program are conducted at the E-MAD (Engine Maintenance, Assembly and Disassembly) facility in Area 25 of the Nevada Test Site. Brief discussions of E-MAD activities are included in this report. Significant accomplishments for this period are as follows: (1) Integrity monitoring of the 17 fuel assemblies located at E-MAD was performed to determine if handling, packaging, or storage had affected the overall integrity of the fuel. (2) The 24-month Dry Storage Fuel Integrity Demonstration Test being conducted at the E-MAD facility was completed. Two fuel rods, removed from the assembly prior to the test, were reinserted into the fuel assembly. (3) The remaining nine fuel assemblies were removed from their seal-welded canisters and characterized to verify their integrity following storage tests. (4) The decay heat rates of five fuel assemblies were measured using the E-MAD boiling water calorimeter. The measured decay heat rates were compared to predicted rates. (5) At DOE/NV request, plans were prepared and submitted to ship the 17 E-MAD fuel assemblies to the Idaho National Engineering Laboratory and then shut down the E-MAD facility. (6) The revised safety assessment document was approved and transmitted to DOE/NV. (7) Quality Assurance personnel assisted in the completion of the DOE/NV Quality Assurance Manual and it was approved and published. (8) Technical support was provided to Lawrence Livermore National Laboratories in the decontamination of electronic equipment.

10990 **(DOE/RW—0045) Implementation plan for deployment of Federal Interim Storage facilities for commercial spent nuclear fuel.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Jan 1986. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005522.

This document is the third annual report on plans for providing Federal Interim Storage (FIS) capacity. References are made to the first and second annual reports, as necessary. Background factors and aspects that were considered in the development of this deployment plan and activities and interactions considered to be required to implement an FIS program are discussed. A generic description of the approach that the Department plans to follow in deploying FIS facilities is also described. 12 refs., 1 fig., 1 tab.

10991 **(SAND—85-7240) Assessment of the US Department of Transportation's radioactive materials routing report.** Sell, C.E.; Welles, B.W. (International Energy Associates Ltd., Washington, DC (USA)). Jan 1986. Contract AC04-76DP00789. 40p. (TTC—0609; IEAL-R—85-24). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005275.

The US Department of Transportation (DOT) requires post-notification of highway route controlled quantity shipments of radioactive materials. The US Nuclear Regulatory Commission (NRC), the US Department of Energy (DOE), and NRC-licensed shippers of designated quantities of radioactive materials provide this post-notification to DOT. DOT compiles the routing data in the Radioactive Materials Routing Report (RAMRT). The RAMRT may be a useful source of data for research and development leading to improved safety and efficiency of highway shipments of radioactive materials.

10992 **(SAND—85-7242) Developments over the last two years concerning nuclear transportation and federal preemption.** Brown, O.F. II. (Brown (Omer F. II), Washington, DC (USA)). Jan 1986. Contract AC04-76DP00789. 23p. (TTC—0608). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004229.

This report summarizes the significant developments affecting nuclear transportation activities and Federal preemption that have occurred over the last two fiscal years (1984 and 1985). The most significant developments in this period were the decision by the US Supreme Court in 1984 not to accept the New York City case; the issuance by the US Department of Transportation (DOT) of its long-awaited inconsistency rulings concerning state or local transportation restructions in the states of New York, Michigan, Vermont and Arizona; and, DOT's denial in September 1985 of New York City's application for a nonpreemption determination. By way of background, DOT has published national safety standards, commonly referred to as HM-164, for highway transportation of radioactive materials. HM-164 generally requires carriers of "highway route controlled quantities" of radioactive materials to use Interstate highways, but permits a state agency to substitute non-Interstate roads for Interstate segments, or to add additional highways to what the rule terms "preferred highways" as long as a safety analysis supports the state action. As authorized by Section 112 of the Hazardous Materials Transportation Act of 1974 (HMTA), HM-164 expressly preempts inconsistent state and local rules, but specifically allows states and localities to petition DOT for non-preemption. While the framework governing federal preemption for nuclear materials transportation has had some clouds removed by the last two year's DOT inconsistency rulings and nonpreemption determination, and the various court decisions, states and localities continue to want, and adopt, additional restrictions. Congress again is being asked to consider changes in the statutory framework that heretofore supposedly was intended to promote uniform national standards. In any case, HM-164 remains to be more fully implemented before spent fuel can be transported routinely under uniform nationwide safety rules.

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 10981

10993 (INIS-mf—10026) Economics of Australian uranium mining. McMahon, P. (International Atomic Energy Agency, Vienna (Austria)). Jul 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780350.

This paper argues that the uranium industry in Australia is inefficient in economic terms. The author also states that it is inefficient in that various social resources are tied up in producing a material which has an intrinsically negative value, in being the raw material for nuclear weapons, and having unacceptable social costs in safety, environmental and cultural problems throughout the process of production and usage.

0520 Waste Management

REFER ALSO TO CITATION(S) 10989, 11057, 11058, 11059, 11060, 11061, 11062, 11063, 11064, 11065, 11066, 11067, 11068, 11069, 11071, 11072, 11073, 11074, 11075, 11076, 11079, 11080, 11081, 11082, 11085, 11389, 11390, 11559, 11585, 11635, 11712, 11722, 11903, 12030, 12031, 12033, 12035

10994 (AEEW-R—1977) Investigation of non-destructive techniques for the examination and quality assurance of cemented radioactive waste. Final report. Price, M.S.T. (UKAEA Atomic Energy Establishment, Winfrith). Aug 1985. 53p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86701195.

Three nondestructive tests for quality assurance of cemented radioactive wastes are considered. These are electrical impedance measurement, paddle torque measurement and gas permeability. Electrical impedance has the advantage that it can be used throughout the mixing, casting and setting processes. The measurement of paddle torque during mixing indicates a measure of the characteristics of the mix. Helium leak rate and total pressure rise techniques have been employed, but leakages at or near the surface due to cracks is a fundamental factor which limits the assessment of cement quality by gas permeation techniques.

10995 (AERE-R—11566) Specification of a test problem for HYDROCOIN Level 1 Case 4: transient thermal convection in a saturated permeable medium. Hodgkinson, D. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Apr 1985. 33p. H.M. Stationery Office, London, price Pound 5.00.

This paper specifies a test problem which is to be used to verify the numerical accuracy of groundwater flow codes, as part of the international HYDROCOIN project. The problem involves transient thermal convection of water in a saturated permeable medium. The analytical solution is presented and the results are tabulated for a particular set of parameter values.

10996 (AERE-R—11753) Calculated solubilities of actinides and some fission and activation products under disposal conditions. Pryke, D.C.; Rees, J.H. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Jun 1985. 15p. H.M. Stationery Office, London, price Pound 4.00.

The elemental solubilities under disposal conditions of a range of actinides and fission and activation products have been calculated under the approximate redox potential (Eh) and pH expected to prevail in the very long term. The majority of activation products will have concentrations some orders of magnitude below the solubilities of their parent elements because of dilution by inactive isotopes. This effect is far less marked for the fission products, and does not exist for the actinides. The sensitivity to changes in Eh and pH is discussed. Changes in Eh are rather more significant than variations in pH, and it is shown that for a few isotopes, maintenance of a reducing environment in the long term will be important in limiting releases to the host rock. Studies aimed at improving the reliability of the thermodynamic data on which these calculations are based should concentrate first on technetium and neptunium, and secondly on two long-lived decay products of the actinides, radium and protactinium.

10997 (ANL/EES-TM—292) Radioactive waste isolation in salt: peer review of Westinghouse Electric Corporation's report on reference conceptual designs for a repository waste package. Rote, D.M.; Hull, A.B.; Was, G.S.; Macdonald, D.D.; Wilde, B.E.; Russell, J.E.; Kruger, J.; Harrison, W.; Hambley, D.F. (Argonne National Lab., IL (USA)). Oct 1985. Contract W-31-109-ENG-38. 97p. NTIS, PC E06/MF A01; GPO Dep. File Number DE86004965.

Includes 3 sheets of 48x reduction microfiche.

This report documents the findings of the peer panel constituted by Argonne National Laboratory to review Region A of Westinghouse Electric Corporation's report entitled Waste Package Reference Conceptual Designs for a Repository in Salt. The panel determined that the reviewed report does not provide reasonable assurance that US Nuclear Regulatory Commission (NRC) requirements for waste packages will be met by the proposed design. It also found that it is premature to call the design a "reference design," or even a "reference conceptual design." This review report provides guidance for the preparation of a more acceptable design document.

10998 (BMI/ONWI—569) Origin of fluid inclusion water in bedded salt deposits, Palo Duro Basin, Texas. Knauth, L.P.; Beeunas, M.A. (Arizona State Univ., Tempe (USA)). Jul 1985. Contract AC02-83CH10140. 65p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004664.

Salt horizons in the Palo Duro Basin being considered for repository sites contain fluid inclusions which may represent connate water retained in the salt from the time of original salt deposition and/or external waters which have somehow penetrated the salt. The exact origin of this water is important to the question of whether or not internal portions of the salt deposit have been, and are likely to be, isolated from the hydrosphere for long periods of time. The $^{18}O/^{16}O$ and D/H ratios measured for water extracted from solid salt samples show the inclusions to be dissimilar in isotopic composition to meteoric waters and to formation waters above and below the salt. The fluid inclusions cannot be purely external waters which have migrated into the salt. The isotope data are readily explained in terms of mixed meteoric-marine connate evaporite waters which date back to the time of deposition and early diagenesis of the salt (>250 million years). Any later penetration of the salt by meteoric waters has been insufficient to flush out the connate brines.

10999 (DOE/DP—0027) Evaluation of "Commercial Repository Capacity for the Disposal of Defense High-Level Waste." Response to comments. (USDOE Assistant Secretary for Defense Programs, Washington, DC. Defense Waste and Byproducts Div.). Dec 1985. 332p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE86005423.

The Nuclear Waste Policy Act of 1982 (Public Law 97-425) requires that the President evaluate the use of disposal capacity at one or more repositories to be developed for permanent disposal of civilian spent nuclear fuel and high-level radioactive waste for the disposal of defense high-level radioactive waste. The Department of Energy prepared a report titled "An Evaluation of Commercial Repository Capacity for the Disposal of Defense High-Level Waste," DOE/DP-0020, to provide input for the President's evaluation. The report constituted the Department's input and recommendation to be considered by the President in making his evaluation. Although not required by the Act, the Department made the July 1984 draft of the report available to the general public for review and comment in order to increase public awareness, and develop a public record on the issue of disposal of defense high-level waste. Over 400 copies of the draft report were distributed. Thirty comment letters containing over 400 comments were received from representatives of states, localities, and Indian tribes, federal agencies, organizations representing utilities, public interest groups, individual utilities, and private citizens. This report contains these letters and responses to the comments.

11000 (DOE/ID/12509—1) Investigation of siting parameters for near surface disposal of low-level nuclear waste. Final report. Schell, W.R.; Sanchez, A.L.; Thomas, E.D. (Pittsburgh Univ., PA (USA). Graduate School of Public Health). 15 Dec 1985. Contract FG07-84ID12509. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86005498.

A study was initiated in April 1984 to evaluate actual problems associated with and to recommend improvements for near surface disposal of low-level radioactive wastes in the State of Pennsylvania and the humid Northeast. The results of field measurements showed some vertical transport of ^{137}Cs and other fallout radionuclides in ^{210}Pb dated peat cores from the unsaturated zone. Under the natural acid rain conditions (pH 4.0), the most mobile radionuclide, ^{137}Cs, gave diffusion coefficients of 10^{-7} to 10^{-9} cm^2/sec in the different organic rich soils. Both the upward and downward migration of radionuclides resulted from the hydrological cycle of evapotranspiration and precipitation which gave diffusive mixing of mobile radionuclides. The distribution coefficient, K/sub d/ values, for several radionuclides in the organic rich soils were found to be equal to or greater than those measured previously for inorganic clay and sediment matrices. To insure that radionuclides do not enter water supplies in the humid Northeast where pH 4.0 rain is encountered, a peat liner should be considered in the multibarrier design of repositories. 32 refs., 16 figs., 8 tabs.

11001 (DOE/LLW—18T-Rev.6) Radioactive waste management: a summary of state laws and administration. National Low-Level Radioactive Waste Management Program. Revision 6. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1985. Contract AC07-76ID01570. 466p. NTIS, PC A20/MF A01; GPO Dep. File Number DE86004602.

This is the sixth update of "Radioactive Waste Management: A Summary of State Laws and Administration." It completely replaces the fifth update (15 September 1984). The updated report covers low-level radioactive waste compacts, and the administration, the legislature and the laws related to radioactive waste management in each of the fifty states. The report is organized by low-level waste compact regions. Each section begins with a description of the low-level waste compact, followed by reports on each state within the region. There are also sections for states which have made plans to dispose of waste independently of a compact, and for those states which have not yet declared their intentions. The report on each compact is divided into four sections: Cover Page, Chair Organization, State Delegations, and Compact.

11002 (DOE/LLW—31T) Analysis of alternatives for greater-confinement disposal of low-level radioactive waste. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1985. Contract AC07-76ID01570. 149p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86005107.

A comparative method for evaluating technical alternatives for greater-confinement disposal (GCD) of low-level radioactive waste (LLW) is developed and applied to nine GCD alternatives. The bounding alternatives are a conventional shallow-land burial (SLB) facility (used as a reference facility for comparative determination of costs and risks) and a deep geologic repository. The other alternatives include a deep trench, improved waste form, engineered structures, boreholes, hydrofracture, and a shallow repository. The method ranks the alternatives based on a ranking parameter, RP equals C (cost in dollars) plus H (health risk converted to dollars), which is derived from benefit-cost-risk analysis. Costs are developed for a GCD facility that is co-located with a conventional SLB facility and has a capacity of 10,000 m^3 of GCD waste; risks are based on a pathway analysis for estimating the dose to individuals resulting from waste placed in a GCD facility. Application of the method, using a generic analysis based on representative waste streams of intermediate-activity and high-activity LLW that would require GCD, indicates that all alternatives except the reference SLB facility can be expected to meet performance objectives (500 mrem/yr wholebody dose to onsite intruders; 25 mrem/yr wholebody dose to members of the general public from releases to the environment). All of the alternatives considered are equivalent within the resolving power of the generic analysis, except for the repository designs, which are considerably more costly with negligible concomitant reduction in health risks. Site-specific application of the method, with more detailed design information, would be needed in order to provide a basis for selecting an optimum GCD alternative in any actual situation.

11003 (DOE/NE—0025/4) Annual status report on the Uranium Mill Tailings Remedial Action Program. (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Remedial Action and Waste Technology). Dec 1985. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004535.

FY 1985 project accomplishments include: completed 90% of the processing site remedial actions at Canonsburg, Pennsylvania, and initiated remedial actions at Salt Lake City, Utah, and Shiprock, New Mexico; awarded remedial action contracts on 329 vicinity properties at seven designated locations and completed survey and inclusion activities on a total of 1620 vicinity properties; published the Environmental Assessment (EA) for Lakeview, Oregon, issued the draft and prepared the final Environmental Impact Statement (EIS) for Durango, Colorado; completed the Remedial Action Plan (RAP) for Lakeview, Oregon, and prepared the draft RAP for Durango, Colorado; executed cooperative agreements with Idaho, New Mexico, and the Navajo Nation/Hopi Tribe; executed a Memorandum of Understanding with the Nuclear Regulatory Commission; and developed proposed UMTRA Project design review criteria between DOE and the NRC.

11004 (DOE/OR/21558—1) Phase I decontamination of the J.C. Haynes site, Newark, Ohio. Final report. Emswiler, T.R. (Battelle Columbus Labs., OH (USA)). Nov 1985. Contract AC05-85OR21558. 152p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86004518.

Phase I consisted of the primary decontamination, packaging, and shipment of all ^{241}Am-contaminated gloveboxes, vent system, and miscellaneous waste items located in the laboratory restricted area in the J.C. Haynes house. The primary goals of Phase I were to locate and account for a major quantity of ^{241}Am which was unaccounted for and to remove all radioactive materials and contamination posing an imminent hazard to public health and safety. All Phase I operations were conducted under a Quality Assurance (QA) Program Plan and QA procedures written specifically for this program. In addition, certain generic Battelle QA procedures were used for routine tasks. All operations were conducted under strict health physics supervision and procedures. Cognizant ORAU and US Nuclear Regulatory Commission (NRC) personnel were on site during the entire Phase I operation and provided support and approval in the daily operations. All staff members had participated in previous decontamination and decommissioning programs involving transuranic waste and completed Phase I in a well controlled, timely, and safe manner.

11005 (DOE/RW—0006-Rev.1) Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 312p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE86005264.

Current inventories and characteristics of commercial spent fuels and both commercial and US Department of Energy (DOE) radioactive wastes were compiled through December 31, 1984, based on the most reliable information available from government sources and the open literature, technical reports, and direct contacts. Future waste and spent fuel to be generated through the year 2020 and characteristics of these materials are also presented. The information forecasted is consistent with the expected defense-related and private industrial and institutional activities and the latest DOE/Energy Information Administration (EIA) projections of US commercial nuclear power growth. Materials considered, on a chapter-by-chapter basis, are: spent fuel, high-level waste, transuranic waste, low-level waste, commercial uranium mill tailings, remedial action waste, and decommissioning waste. For each category, current and projected inventories are given through the year 2020, and the radioactivity and thermal power are calculated, based on reported or calculated isotopic compositions.

11006 **(DOE/RW—0038-Draft) Information Services Directory.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Nov 1985. 102p. NTIS, PC A06; 3; GPO Dep. File Number DE86004487.

The Information Services directory is intended to facilitate participation by states, affected Indian tribes and the public in the Civilian Radioactive Waste Management program. The Directory is produced by the Information Services Division of the OCRWM's Office of Policy and Outreach and will be updated periodically. It is a reference document that identifies the sources of available program information.

11007 **(DOE/RW—0040) Managing the nation's nuclear waste. Site descriptions: Cypress Creek, Davis Canyon, Deaf Smith, Hanford Reference, Lavender Canyon, Richton Dome, Swisher, Vacherie Dome, and Yucca Mountain.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). 1985. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005395.

In 1982, the Congress enacted the Nuclear Waste Policy Act (Public Law 97-425), which established a comprehensive national program directed toward siting, constructing, and operating geologic repositories for the permanent disposal of high-level radioactive waste. In February 1983, the United States Department of Energy (DOE) identified the nine referenced repository locations as potentially acceptable sites for a mined geologic repository. These sites have been evaluated in accordance with the DOE's General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories. The DOE findings and determinations are based on the evaluations contained in the draft Environmental Assessments (EA). A final EA will be prepared after considering the comments received on the draft EA. The purpose of this document is to provide the public with specific site information on each potential repository location.

11008 **(DOE/RW—0043) Program Management System manual.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Jan 1986. 95p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86005396.

The Program Management System (PMS), as detailed in this manual, consists of all the plans, policies, procedure, systems, and processes that, taken together, serve as a mechanism for managing the various subprograms and program elements in a cohesive, cost-effective manner. The PMS is consistent with the requirements of the Nuclear Waste Policy Act of 1982 and the "Mission Plan for the Civilian Radioactive Waste Management Program" (DOE/RW-0005). It is based on, but goes beyond, the Department of Energy (DOE) management policies and procedures applicable to all DOE programs by adapting these directives to the specific needs of the Civilian Radioactive Waste Management program. This PMS Manual describes the hierarchy of plans required to develop and maintain the cost, schedule, and technical baselines at the various organizational levels of the Civilian Radioactive Waste Management Program. It also establishes the management policies and procedures used in the implementation of the Program. These include requirements for internal reports, data, and other information; systems engineering management; regulatory compliance; safety; quality assurance; and institutional affairs. Although expanded versions of many of these plans, policies, and procedures are found in separate documents, they are an integral part of this manual. The PMS provides the basis for the effective management that is needed to ensure that the Civilian Radioactive Waste Management Program fulfills the mandate of the Nuclear Waste Policy Act of 1982. 5 figs., 2 tabs.

11009 **(DOE/WIPP—221) Waste Isolation Pilot Plant. Quarterly geotechnical field data report, April-June 30, 1985.** (Bechtel National, Inc., San Francisco, CA (USA). Advanced Technology Div.). Dec 1985. Contract AC04-78AL10751. 625p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE86004904.

This Quarterly Geotechnical Field Data Report (GFDR) presents information obtained from the geotechnical studies at the WIPP site underground facilities from April 1 through June 30, 1985, as well as all previous data collected from the geomechanical instruments. During this period, the geotechnical activities at the site included maintaining and repairing instruments and monitoring previously installed geomechanical instruments in shafts, underground drifts, and test rooms. The data presented in this GFDR reflect the update of continuing measurements and monitoring. Also continuing and included in this report are preliminary geotechnical and structural analyses and interpretations of the data. The GFDR is organized into two principal parts. The first part, Geotechnical Field Data, presents in graphical form all the data collected since April 1982 from the geomechanical instruments. Presented in the second part, Evaluation and Analyses, are preliminary interpretations and analyses of the data. In this report, continuing geotechnical assessment of all the facility features is presented. The computational analyses section presents the preliminary analysis of the waste shaft. Also included in the second part are separate sections on evaluation and interpretation of the instrumentation measurements, and an updated description and evaluation of observed behavior of the underground openings.

11010 **(DP-MS—85-117) Thermal properties of fly ash substituted slag cement waste forms for disposal of Savannah River Plant salt waste.** Roy, D.M.; Kaushal, S.; Licastro, P.H.; Langton, C.A. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1985. Contract AC09-76SR00001. 10p. (CONF-851217—17). NTIS, PC A02. File Number DE86004893.

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

Waste processing at the Savannah River Plant will involve reconstitution of the salts ($NaNO_3$, $NaNO_2$, NaOH, etc.) into a concentrated solution (32 weight percent salts) followed by solidification in a cement-based waste form for burial. The stability and mechanical durability of such a 'saltstone monolith' will depend largely on the temperature reached due to heat of hydration and the thermal properties of the waste form. Fly ash has been used as an inexpensive constituent and to moderate the hydration and setting processes so as to avoid reaching prohibitively high temperatures which could cause thermal stresses. Both high-calcium and low-calcium fly ashes have been studied for this purpose. Other constituents of these mixes include granulated blast furnace slag and finely crushed limestone. Adiabatic temperature increase and thermal conductivity of these mixes have been studied and related x-ray diffraction and scanning electron microscopy studies carried out to understand the hydration process.

11011 **(EGG—2427) Long-range plan for buried transuranic waste studies at the Idaho National Engineering Laboratory.** Low, J.O. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1985. Contract AC07-76ID01570. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005010.

This document presents a plan to perform detailed studies of alternatives considered for the long-term management of buried transuranic waste at the Idaho National Engineering Laboratory (INEL). The studies will provide the technical basis for DOE to make a decision on the future management of that waste. Although the waste is currently being handled in an acceptable manner, new solutions are continually being researched to improve management techniques. Three alternatives are being considered: (a) leave the waste as is; (b) improve in situ confinement of the waste; and (c) retrieve, process, and certify the waste for disposal at a federal repository. Fourteen studies are described in this plan for Alternatives 2 and 3. The leave-as-is alternative involves continuing present procedures for managing the buried waste. An ongoing environmental surveillance program, a low-level-waste stabilization program, and enhanced subsurface migration studies begun in FY-1984 at the INEL will provide data for the decision-making process for the INEL buried TRU waste. These ongoing studies for the leave-as-is alternative are summarized in this plan in limited detail. The improved-confinement alternative involves leaving the waste in place, but providing additional protection against wind, water penetration, erosion, and plant and animal intrusion. Several studies proposed under this alternative will examine special techniques to immobilize or encapsulate the buried waste. An in situ grouting study was implemented at the INEL starting in FY-1985 and will be completed at the end of FY-1986 with the grouting of a simulated INEL buried TRU waste trench. Studies of the third alternative

will investigate improved retrieval, processing, and certification techniques. New equipment, such as industrial manipulators and excavating machinery, will be tested in the retrieval studies. Processing and certification studies will examine rapidly changing or new technologies.

11012 **(EGG—2429) Annual technology assessment and progress report for the Buried Transuranic Waste Program at the Idaho National Engineering Laboratory.** Low, J.O. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1985. Contract AC07-76ID01570. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86005011.

An improved-confinement technology as applied to the Idaho National Engineering Laboratory (INEL) shallow-land-buried transuranic (TRU) waste is being investigated. An improved-confinement technology, in situ grouting, is being demonstrated in a 2-year engineering feasibility test at the INEL. Grout formulation and development were completed by Oak Ridge National Laboratory in Tennessee to support the in situ grouting test. Three grout formulations have been adapted to the arid, unsaturated soil conditions at the INEL: ordinary particulate grout; microfine penetration grout; soil grout. Three test trenches were constructed north of the INEL's Subsurface Disposal Area (SDA). Nonradioactive waste forms closely resembling TRU waste buried at the INEL have been fabricated and are ready for emplacement into these test trenches. A literature search for a simulated (analog) TRU tracer was completed as well as a chemical characterization of the INEL soil. Data developed from the chemistry characterization and literature search have been inputed into the selection and laboratory testing of the TRU analog tracers. Simulated TRU tracers will be loaded into waste forms prior to emplacement into the test trenches. Test trench data acquisition instrumentation will be installed during waste form emplacement. Instrumentation will monitor for moisture movement and tracer detection. Plans for test completion in FY-1986 are also shown. Various buried waste improved-confinement technologies performed by other Department of Energy sites were assessed for applicability to the INEL buried TRU waste. Primary demonstrations were performed at the Hanford site in Washington and at ORNL. This report also includes information on accomplishments of related activities at the INEL such as the program for Environmental Surveillance of the Radioactive Waste Management complex as well as the Subsurface Migration Studies. 18 refs., 11 figs., 12 tabs.

11013 **(EGG-M—23085) Low level waste data base development - EPICOR-II resin/liner investigation. Program review.** McConnell, J.W. Jr. (EG and G Idaho, Inc., Idaho Falls (USA)). 10 Sep 1985. Contract AC07-76ID01570. 14p. (CONF-8509121—25). NTIS, PC A02 - GPO. File Number DE86004115.

From 7. annual DOE LLWMP participants information meeting; Las Vegas, NV, USA (10 Sep 1985).

This paper presents an overview of the titled program and gives the status of the work on resin degradation, resin solidification, and field testing of solidified samples. A brief discussion of some recent results is also included. Resin materials from EPICOR-II prefilters used in the cleanup of the Three Mile Island Nuclear Power Station are being examined to (1) develop a low level waste data base and (2) obtain information on survivability of waste forms composed of ion exchange media loaded with radionuclides and solidified in matrices of cement and Dow polymer. An unusual aspect of this investigation is the use of commercial grade resins which have been loaded with over five times the radioactivity normally seen in a commercial application. That dramatically increases the total radiation dose to the resins. 18 refs., 8 figs.

11014 **(EGG-PBS—7013) Technical evaluation of the G.E. Transportable Modular AZTECH Plant topical report.** Henscheid, J.W.; Stalker, A.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1985. Contract AC07-76ID01570. 17p. NTIS, PC A02/MF A01 - GPO. File Number TI86005326.

This report summarizes EG and G Idaho's review of the General Electric Company's topical report on their Transportable Modular AZTECH Plant. The review evaluated compliance with pertinent codes, standards and regulations. The initial review was discussed with G.E. and all outstanding issues resolved before this final evaluation was made.

11015 **(EGG-PBS—7027) Technical evaluation of the topical report on the Koch Process Systems Low-Level Radwaste Volume Reduction System.** Henscheid, J.W.; Ayers, A.L. Jr. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1985. Contract AC07-76ID01570. 13p. NTIS, PC A02/MF A01 - GPO. File Number TI86005328.

This report summarizes EG and G Idaho's review of the Koch Process Systems topical report on a Low-level Radwaste Volume Reduction System. The review evaluated compliance with pertinent codes, standards and regulations. The initial review was discussed with Koch, and all outstanding issues resolved before this final evaluation was made.

11016 **(EUR—9220) PAGIS summary report of phase 1: a common methodological approach based on European data and models.** Cadelli, N.; Cottone, G.; Bertozzi, G.; Girardi, F. (Commission of the European Communities, Ispra (Italy). Joint Research Centre; Commission of the European Communities, Luxembourg). 1984. 162p. Commission of the European Communities, Ispra, Italy. Joint Research Center.

Since 1982 a joint study has been launched by the CEC with the participation of national institutions in the E.C., aiming at a Performance Assessment of Geological Isolation Systems (PAGIS) for HLW disposal. This document is a summary of the first phase of the study which was devoted to the collection of data and models and to the choice of an appropriate methodology. To this purpose, real or national sites have been chosen, which are representative of three types of continental geological formations in the E.C.: clay, granite and salt (although the choices imply no committment of any kind about their final use). Moreover, sub-seabed areas have also been identified. The study covers the following items: - basic data on waste characteristics, site data and repository designs; - methodology, which allows sensitivity and uncertainty analyses to be performed, as well as the assessment of radiation doses to individuals and populations; - preliminary modelling of radionuclide release and migration through the geosphere (near- and far-field) and the biosphere following their various pathways to man; - selection of the most relevant radionuclide release scenarios and their probability of occurrence. Reference values have been selected for the basic data as well as variants covering the various options which are under consideration in the different Countries of the E.C.

11017 **(EZ-OPLA—1) Proposal for a research programme on geological disposal of radioactive waste in the Netherlands. At the request of the Integrated National Research Program - Nuclear Waste (ILONA) Policy Committee.** (Ministry of Economic Affairs, The Hague (Netherlands). Onshore Disposal Committee (OPLA)). Jun 1984. 112p. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701198.

The present report sets out a tentative research program related to radiologic safety of geological disposal of radioactive waste, set against the background of present knowledge in this field. The final stage of this program has to lead to a definitive appraisal of the suitability of the site explored in that stage for disposal of high-level radioactive waste. Subsequent stages of the research effort is outlined in a critical path diagram. Radiological safety figures as the central factor in making choices. The report indicates the state of the art in different specialisms involved in the study of both natural barriers (rheology, hydrology, radionuclide transport, radiation damage) and artificial barriers (mining engineering) for geological disposal. (G.J.P.). 73 references, 2 figures, 5 tables.

11018 **(IAEA-R—3182-F) Tritiated waste water fixation of solid materials. Final report for the period 1 September 1982-31 August 1985.** Todorovic, M. (International Atomic Energy Agency, Vienna (Austria); Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). Aug 1985. vp.

The exchange kinetics between tritiated and distilled water (THO/H_2O) from various zeolites, natural and synthetic analcimes, saturated with THO are reported. Kinetic parameters for the diffusion process are calculated from experimental data. Tritiated water

releases from the zeolites saturated with THO into distilled water is given for various temperatures and times. Ferric, zinc, cobalt and sodium zeolites are investigated. Results indicated that cobalt zeolite and synthetic analcime release rates of THO are superior to the other zeolites tested.

11019 **(IAEA-TECDOC—337) Inorganic ion exchangers and adsorbents for chemical processing in the nuclear fuel cycle. Proceedings of a technical committee meeting organized by the IAEA and held in Vienna, 12-15 June 1984.** (International Atomic Energy Agency, Vienna (Austria)). Jul 1985. 282p. (CONF-8406123—). NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463.

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

The application of inorganic ion exchangers and adsorbents to both waste treatment and the recovery of fission products and actinides were of primary concern at this meeting. The meeting covered the two major fields of fundamental studies and industrial applications.

11020 (IAEA-TECDOC—337, pp 9-17) **Sodium titanate. A highly selective inorganic ion exchanger for strontium.** Lehto, J.; Miettinen, J.K. (Helsinki Univ. (Finland). Dept. of Radiochemistry). Jul 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463. (CONF-8406123—).

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

A strontium-selective inorganic ion exchanger, sodium titanate, has been synthesized from an industrial intermediate of a titanium dioxide pigment process. The distribution coefficient of sodium titanate for strontium is high, nearly 10^5 at a pH above 7. The sorption capacity is also high: 1.4 mmol of strontium per gram of exchanger. The effect of high concentrations of sodium chloride, boric acid, sodium citrate and EDTA on the sorption has been studied. The sorption rate of strontium in sodium titanate has been found to be rather high. The exchanger is highly resistant to gamma radiation. A gamma irradiation dose of 10^7 Gy has practically no effect on its structure and sorption properties. Decontamination factors higher than 100 have been obtained for strontium from two actual nuclear power plant waste solutions.

11021 (IAEA-TECDOC—337, pp 53-62) **Application of silver-free zeolites to remove iodine from dissolver off-gases in spent fuel reprocessing plants.** Sakurai, T.; Komaki, Y.; Takahashi, A.; Izumo, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki). Jul 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463. (CONF-8406123—).

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

The present work dealt with the interaction of zeolite 13X with such organic iodides as CH_3I and C_2H_5I in the presence of NO_2 with the intention of applying silver-free zeolites to the iodine removal process of the dissolver off-gas. On the assumption that the dissolver off-gas would be dried for the purpose of removal of tritium, the experiments were carried out under a dry condition. Zeolite 13X removes dilute CH_3I from a process gas stream with high efficiencies at approx. 25 deg. C. It was found that NO_2 decomposed CH_3I on the zeolite. Infrared analysis and mass spectrometry confirmed that this reaction took place on zeolite 13X and also on a silver-exchanged zeolite at approx. 25 deg. C. When a simulated dissolver off-gas (containing approx. 100 ppm-I_2, approx. 10 ppm-CH_3I and approx. 1%-NO_2) was supplied to a zeolite 13X bed, the I_2 which was produced by the decomposition of CH_3I and was absorbed at the same place of the bed as another I_2 which was originally included in the gas. At approx. 100 deg. C, the zeolite 13X bed traps only iodine and NO_2 passes through the bed without being adsorbed: the zeolite can separate iodine chromatographically from NO_2. On the basis of these experimental results, an iodine removal process was discussed.

11022 (IAEA-TECDOC—337, pp 133-142) **Separation and purification of fission products from process streams of irradiated nuclear fuel.** Ali, S.A.; Ache, H.J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie). Jul 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463. (CONF-8406123—).

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

New results are presented of studies of the application of inorganic exchangers in the following fields: a) Concentration and removal of fission product molybdenum from solutions of irradiated, short-cooled fuel element targets by attachment to water-containing metal oxides and subsequent thermal desorption of MoO_3 from the stationary phase. The volatilization yields were clearly improved by the addition of water vapor to the mobile gas phase. b) Chromatographic removal of cesium from the aqueous medium-active waste streams of nuclear fuel reprocessing plants on ammonium molybdatophosphate, ammonium hexacyanocobalt ferrate and zirconium phosphate. In this case, stationary phases of ammonium molybdatophosphate were found to be by far the most efficient exchangers among those studied.

11023 **(INIS-mf—10025) Stripa project quarterly report. October through December 1984.** (Swedish Nuclear Fuel and Waste Management Co., Stockholm). 1985. 52p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86780349.

1. General; 2. Hydrogeological characterization of the stripa site - phase 1; 3. Hydrogeochemical characterization of the stripa groundwaters; 4. Buffer mass test (BMT); 5. Cross-hole techniques for the detection and characterization of fracture zones; 6. 3-dimensional migration experiment; 7. Borehole and shaft; 8. Economy.

11024 **(NAK—3) Encapsulation of spent nuclear fuel in ceramic materials. An introductory study.** Forberg, S.; Westermark, T. (National Board for Spent Nuclear Fuel, Stockholm (Sweden)). Mar 1983. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700480.

The international situation with regard to disposition of spent nuclear fuel is surveyed, with emphasis on encapsulation in ceramic materials. The feasibility and advantages of ceramic containers, thermodynamically stable in groundwater, are discussed as well as the possibility to ensure that stability for longevity by engineered measures. The design prerequisites are summarized and suggestions are made for a conceptual design, comprising rutile containers with stacks of coiled fuel pins. A novel technique is suggested for the homogeneous sealing of rutile containers at low temperatures, acceptable also for the fuel pin package. Key points are given for research, demonstration and verifications of the design foundations and for future improvements, of which a few ideas are exemplified.

11025 **(NUREG/CR—2482-Vol.8) Review of DOE Waste Package Program. Semiannual report, October 1984-March 1985. Volume 8.** Davis, M.S. (ed.). (Brookhaven National Lab., Upton, NY (USA)). Dec 1985. Contract AC02-76CH00016. 402p. (BNL-NUREG—51494-Vol.8). NTIS, PC A18/MF A01 - GPO. File Number TI86005240.

A large number of technical reports on waste package component performance were reviewed over the last year in support of the NRC's review of the Department of Energy's (DOE's) Environmental Assessment reports. The intent was to assess in some detail the quantity and quality of the DOE data and their relevance to the high-level waste repository site selection process. A representative selection of the reviews is presented for the salt, basalt, and tuff repository projects. Areas for future research have been outlined. 141 refs.

11026 **(NUREG/CR—4323) Protection of uranium tailings impoundments against overland erosion.** Walters, W.H.; Skaggs, R.L. (Pacific Northwest Labs., Richland, WA (USA)). Jan 1986. Contract AC06-76RL01830. 57p. (PNL—5520). NTIS, PC A04/MF A01 - GPO. File Number TI86005079.

This study investigates the problems involved in designing protection methods to prevent erosion of a uranium tailings impoundment cover from rainfall and runoff (overland flow) processes. The study addresses the side slopes and top surface as separate elements. The side slopes are more subject to gully erosion and require absolute protection such as that provided by rock riprap. The flatter top surface needs much less protection (vegetation/rock combinations) but some estimate of erosion rates are needed to compare alternatives. A literature review indicated that, currently, procedures are not available for the design of rock riprap to prevent gully erosion. Therefore, rock protection on the side slope will have to be based upon engineering judgment determined by the particular site conditions. The Manning-kinetic equations (velocity and depth of runoff) were investigated as a possible aid to the design of gully erosion protection. Guidelines are suggested for the use of rock riprap to prevent gully erosion. Three mathematical models were used to compute erosion rates for the top surface of a hypothetical tailings impoundment. The results recommend that one or possibly both of the regression models could be used to evaluate preliminary protection designs for the top surface. A physical process simulation model should be used for the final design. 30 refs., 13 figs., 16 tabs.

11027 **(ORNL/TM—9877) Characterization plan for Solid Waste Storage Area 6.** Boegly, W.J. Jr.; Dreier, R.B.; Huff, D.D.; Kelmers, A.D.; Kocher, D.C.; Lee, S.Y.; O'Donnell, F.R.; Pin, F.G.; Smith, E.D. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86004594.

Solid Waste Storage Area 6 (SWSA-6) is the only currently operating low-level radioactive waste (LLW) shallow land burial facility at the Oak Ridge National Laboratory. The US Department of Energy (DOE) recently issued DOE Order 5820.2, which provides new policy and guidelines for the management of radioactive wastes. To ensure that SWSA-6 complies with this Order it will be necessary to establish whether sufficient data on the geology, hydrology, soils, and climatology of SWSA-6 exist, and to develop plans to obtain any additional information required. It will also be necessary to establish a source term from the buried waste and provide geochemical information for hydrologic and dosimetric calculations. Where data gaps exist, methodology for obtaining this information must be developed. The purpose of this Plan is to review existing information on SWSA-6 and develop cost estimates and schedules for obtaining any required additional information. Routine operation of SWSA-6 was initiated in 1973, and it is estimated that about 29,100 m^3 (1,000,000 ft^3) of LLW containing about 250,000 Ci of radioactivity have been buried through 1984. Since SWSA-6 was sited prior to enactment of current disposal regulations, a detailed site survey of the geologic and hydrologic properties of the site was not performed before wastes were buried. However, during the operation of SWSA-6 some information on site characteristics has been collected.

11028 **(PNL—5635) Instrumentation for remote monitoring and control of liquid-fed ceramic melters.** Westsik, J.H. Jr.; Wise, B.M.; Spanner, G.E.; Barnes, S.M. (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005102.

New and existing instrumentation for the monitoring and control of the liquid-fed ceramic melter (LFCM) process have been tested and evaluated. The use of thermocouples for the monitoring of the glass melting process to assure a quality product and to monitor the condition of the melter equipment is well developed. Additional information about the operation of the melter including foaming, feeding, and cold cap coverage can be obtained from the temperature data. A melter viewing system consisting of an infrared camera and associated electronics has been demonstrated to provide clear pictures of the melter interior and cold cap surface during melter operation. The pneumatic level detection system functions well for measuring glass specific gravity and glass level in the melter. Further testing is needed to assess its capabilities for indicating overfeeding, bridging of the cold cap, and foaming. Acoustic monitoring was examined for detection of foaming and overfeeding, and time domain reflectometry was considered for detection of glass level, foaming, and salt formation.

11029 **(PNL-SA—13456) Spent fuel performance in geologic repository environments.** Bradley, D.J. (Pacific Northwest Labs., Richland, WA (USA)). Oct 1985. Contract AC06-76RL01830. 52p. (CONF-8510133—1). NTIS, PC A04/MF A01; GPO Dep. File Number DE86004860.

From Research coordination on performance of solidified HLW forms and engineered barriers under repository conditions; Tokai-mura, Japan (28 Oct 1985).

The performance assessment of the waste package is a current area of study in the United States program to develop a geologic repository for nuclear waste isolation. The waste package is presently envisioned as the waste form and its surrounding containers and possibly a packing material composed of crushed host rock or mixtures of that rock with clays. This waste package is tied to performance criteria set forth in recent legislation. It is the goal of the Civilian Radioactive Waste Management Program to obtain the necessary information on the waste package, in several geologic environments, to show that the waste package provides reasonable assurance of meeting established performance criteria. This paper discusses the United States program directed toward managing high-level radioactive waste, with emphasis on the current effort to define the behavior of irradiated spent fuel in repository groundwaters. Current studies are directed toward understanding the rate and nature (such as valence state, colloid form if any, solid phase controlling solubility) of radionuclide release from the spent fuel. Due to the strong interactive effect of radiation, thermal fields, and waste package components on this release, current spent fuel studies are being conducted primarily in the presence of waste package components over a wide range of potential environments.

11030 **(RHO-BW-SA—381-P) Hydrothermal studies of simulated defense waste glass plus basalt.** Allen, C.C.; Lane, D.L.; Johnston, R.G.; Marcy, A.D.; Adee, R.R. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Pacific Northwest Labs., Richland, WA (USA)). Nov 1984. Contract AC06-77RL01030. 16p. (CONF-841157—101). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004520.

From Materials Research Society annual meeting; Boston, MA, USA (26 Nov 1984).

The Basalt Waste Isolation Project is conducted for the US Department of Energy by Rockwell Hanford Operations. The Basalt Waste Isolation Project has undertaken an experimental program to test the behavior of defense waste glass under conditions relevant to a repository in basalt. Three autoclave experiments utilizing a nonradioactive simulated waste glass (Savannah River Laboratory Type 131/TDS-3A) have been completed. Monolithic discs and crushed glass particles were reacted with crushed basalt and synthetic basalt ground water for ~1 yr at temperatures of 90°C to 150°C. The crushed glass proved considerable more reactive than the monoliths at similar temperatures. Raising the temperature from 90°C to 150°C produced a striking increase in the extent of glass alteration. At 150°C, essentially all of the boron and most of the sodium in the glass particles were released. The major reaction products in all three experiments were smectite clay and zeolites. The two tests utilizing crushed glass also yielded analcime. Nickel, cesium, and strontium, important elements in defense waste, were released from the glass in small quantities. The nickel was incorporated into the clay, while the cesium was incorporated into the analcime. 19 refs., 2 figs., 2 tabs.

11031 **(RHO-BW-SA—406-P) Effect of alpha and gamma radiation on the near-field chemistry and geochemistry of high-level waste packages.** Reed, D.T. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Dec 1985. Contract AC06-77RL01030. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005193.

Ionizing radiation can potentially alter geochemical and chemical processes in a geologic system. These effects can either enhance or reduce the performance of the waste package in a deep geologic repository. Current indications are that, in a repository located in basalt, ionizing radiation significantly affects geochemical/chemical processes but does not appear to significantly affect factors important to the long-term performance of the repository. The experimental results presented in this paper were obtained as part of an ongoing effort by the Basalt Waste Isolation Project to deter-

mine the effect of ionizing radiation on chemical and geochemical processes in the environment of the waste package. Gamma radiolysis experiments were done by subjecting samples of synthetic basalt groundwater in the presence of various waste package components (basalt/packing/low-carbon steel) to high levels of gamma radiation from a ^{60}Co source. Post-irradiation analysis was done on the gas, liquid, and solid components of the basalt system. The results obtained are important in evaluating waste package performance during the containment period. The effect of alpha radiation on the basalt groundwater system in the presence of waste package components is important in evaluating waste package performance during the isolation period. The experimental work in this area is in a very preliminary stage. Results from two experiments are reported. 9 refs., 4 figs., 7 tabs.

11032 **(RHO-PB-SR—10-B-WM-Nov.85) Defense waste and byproducts management monthly report, November 1985.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 1985. Contract AC06-77RL01030. 105p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86005175.

The Waste Isolation Pilot Plant - Waste Acceptance Criteria Certification Committee and Environmental Evaluation Group from the State of New Mexico conducted an audit of the Rockwell Certification Program. Rockwell can now certify the Plutonium and Uranium Extraction (PUREX) Facility newly generated contact handled transuranic waste. The 242-A Evaporator was restarted on November 4 after cleanout of the deentrainer pads which became plugged in early October. Approximately 3.3 million gallons of throughput was achieved during the month with a waste volume reduction of about 1.3 million gallons. Review of the three proposals received on the Project B-475, Part A, Transportable Grout Equipment contract continued in November. Two proposals were determined to be acceptable, contingent upon certain clarifications, and technical discussions are scheduled in December with the two companies. Eight million gallons of groundwater from under the U-1/U-2 cribs were treated during the 167 continuous days of operation from June 13, 1985 to November 26, 1985. A total of 687 kg of uranium were removed. While uranium concentrations in the groundwater have leveled off, well monitoring will continue until spring. The Hazardous Waste Final Facility Permit Part B Application (including Radioactive Mixed Waste - RMW) was revised to incorporate comments received from DOE-RL. The revised Part B was submitted to the USEPA Region X and the WDOE on November 7. The selection of the Architect/Engineer for the Hanford Waste Vitrification Plant Reference Conceptual Design was made by the Department of Energy, Richland Operations Office, on November 21. The firm is Fluor Corporation. Contract negotiations are scheduled to start early in December.

11033 **(RHO-PB-SR—10-B-WM-Oct.85) Defense waste and byproducts management monthly report, October 1985.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 1985. Contract AC06-77RL01030. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86004192.

Three proposals were received October 15 for the Project B-475, Part A, Transportable Grout Equipment contract. Initial review of the proposals by the design review team is to be completed November 5. Nine single-shell tanks were declared Interim Isolated in October; 84 of 149 single-shell tanks have been isolated since the program began. Since June 13, 1985 approximately 6,760,000 gallons of contaminated groundwater have been pumped from under the U-1/U-2 cribs. About 594 kg of uranium have been recovered. Uranium concentrations have been reduced from about 85,000 pC/sub i//L to 14,400 pC/sub i//L measured at the pumping site well. Two additional wells (W-19-17 and 18) are being drilled for investigative/monitoring purposes. Current water quality data indicates that little change is being observed in reducing the uranium concentration levels. Consequently, pumping of the U-1/U-2 crib is planned to stop on November 25, 1985. The pumping process equipment will be winterized and well monitoring will continue until spring. A determination will then be made as to whether pumping will resume. The Hazardous Waste Final Facility Permit Part B Application (including Radioactive Mixed Waste - RMW) was transmitted to DOE-RL on October 25, 1985, thus completing the DOE-RL controlled milestone on schedule. Three acres of Gable Mountain Pond were decommissioned, completing Phase II of Gable Mountain decommissioning. The WESF Safety Analysis Report (SAR), was transmitted to DOE-RL for approval of the Operational Safety Requirements (OSRs). After approval of the OSRs the SAR will be transmitted to DOE-HQ in completion of a DOE-HQ milestone.

11034 **(RHO-WM-EV—12-P) Disposal materials study.** Myers, D.R. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Nov 1985. Contract AC06-77RL01030. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005174.

The Hanford Waste Management Plan describes a reference plan for management and disposal of single-shell tanks, contaminated soil sites, solid-waste burial sites, double-shell tanks, cesium and strontium capsules, retrievably stored transuranic solid wastes, and miscellaneous wastes. One alternative for single-shell tanks, solid-waste burial sites, and contaminated soil sites is in-place disposal, which will require a source of fine soil and crushed basalt. The assumptions made in this document regarding waste disposal are not meant to imply that a specific disposal alternative will be implemented. Implementation of any disposal alternative must await the Record of Deviation for the Hanford Defense Waste-Environmental Impact Study. This document evaluates alternative methods of supplying the fine soil and crushed basalt required for the in-place disposal alternative. This alternative will require single-shell tank domefill and protective barrier construction over single-shell tanks, solid-waste burial sites, and contaminated soil sites. A proposed schedule of material requirements is in appendix B. Four sources of fine soil and three potential sites for a basalt quarry are evaluated. Three alternative methods of material haulage (conveyor, truck, and rail) are evaluated for the transportation of crushed basalt. The consequences of changing the timing or volume of the material requirements are also considered. 2 refs., 6 figs., 8 tabs.

11035 **(SAAS—323) Safety assessment of underground nuclear waste repositories using the method of status vectors.** Zappe, D.; Runge, K.; Koerner, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic). Sektion Physik; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1985. 77p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE86701199.

Progress made over the past 15 years in the development of methods for assessing the safety of repositories for radioactive wastes in deep continental geological formations is critically reviewed. Then, taking into consideration the state of the art in scenario-consequence analysis and on account of the well-known general difficulties in numerical scenario modelling, a new approach has been proposed which is based on status vectors for different points or short periods of time. The weighted average of the dose components of such status vectors may be regarded as a quantity for repository safety at the time concerned. As an example, numerical results are given for some hypothetical repository states. 123 references.

11036 (SAND—85-0380, pp 11-16) **How reliable does the waste package containment have to be.** Wick, E.A. (Nuclear Regulatory Commission, Washington, DC). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

The final rule (10 CFR Part 60) for Disposal of High-Level Radioactive Wastes in Geologic Repositories specifies that the engineered barrier system shall be designed so that, assuming anticipated processes and events, containment of high-level radioactive wastes (HLW) will be substantially complete during the period when radiation and thermal conditions in the engineered barrier system are dominated by fission product decay. This requirement leads to the Nuclear Regulatory Commission (NRC) being asked the following questions: What is meant by "substantially complete".

How reliable does waste package containment have to be. How many waste packages can fail. Although the NRC has not defined quantitatively the term "substantially complete", a numerical concept for acceptable release during the containment period is discussed. The number of containment failures that could be tolerated under the rule would depend upon the acceptable release, the time at which failure occurs and the rate of release from a failed package.

11037 (SAND—85-0380, pp 87-102) **Release mechanisms and their role in the spent fuel repository perfomance.** Peltonen, E.; Snellman, M.; Ollila, K. (Technical Research Centre of Finland). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

The paper presents insights from studies aiming at clarifying the release mechanisms and their role in the overall safety of the final disposal of spent fuel in hard precambrian bedrock. The expected chemical conditions are defined with respect to the materials introduced into the repository, taking into account their possible long-term changes. The main parameters affecting the barrier performance are identified. The parameters affecting the leaching and the solubility of the actinides in the repository are discussed basing on preliminary experimental and theoretical studies. The role of release mechanisms for the safety of the overall disposal system under different conditions is discussed. The importance of the source term is increased when the conditions are assumed to be normal, e.g., the engineering barriers of the repository are damaged. The source term modelling requirements and the data needs are evaluated.

11038 **(SAND—85-1287) Uniaxial and triaxial compression test series on two types of foundry stone.** Price, R.H. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1985. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005105.

Uniaxial and triaxial compression experiments were performed on ten cylindrical samples of foundry stone. All of the test samples were nominally 50.8 mm in diameter, with a 2:1 length to diameter ratio. The experiments were run on room dry samples in compression, at room temperature, four confining pressures, and a nominal axial displacement rate of 10^{-4} mm/s. 3 refs., 8 figs., 5 tabs.

11039 **(SAND—85-1759) ISHTE: component test cruise report. In Situ Heat Transfer Experiment (Atlas Cruise, Leg 1), September 1984.** Percival, C.M. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Dec 1985. Contract AC04-76DP00789. 146p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86004973.

In September of 1984 a cruise was conducted on the R/V MELVILLE to test the various components being designed for the In Situ Heat Transfer Experiment (ISHTE). The location for the test was the designated ISHTE site, MPG-I, north of Hawaii. In addition to successfully testing ISHTE components, significant biological experiments were performed during the cruise. The cruise was very valuable to the continued development of ISHTE in that in situ operations of the platform control and data acquisition systems as well as the various expriments were accomplished. The basic design of the components for ISHTE was confirmed and minor modifications necessary for the completion of the overall design of the ISHTE platform were noted. The successful completion of the component testing was necessary to be able to continue the development of ISHTE with confidence.

11040 **(USGS/WRI—85-4030) Geohydrology of rocks penetrated by test well USW H-4, Yucca Mountain, Nye County, Nevada.** Whitfield, M.S. Jr.; Eshom, E.P.; Thordarson, W.; Schaefer, D.H. (Geological Survey, Denver, CO (USA); Fenix and Scisson, Inc., Mercury, NV (USA)). 1985. Contract AI08-78ET44802. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004490.

This report presents the results of hydraulic testing of rocks penetrated by USW H-4, one of several test wells drilled in the southwestern part of the Nevada Test Site, in cooperation with the US Department of Energy, for investigations related to the isolation of high-level radioactive wastes in volcanic tuffs of Tertiary age. All rocks penetrated by the test well to its total depth of 1219 meters were volcanic. Static water level was at a depth of 519 meters below land surface. Hydraulic-head measurements made at successively lower depths during drilling in this test hole indicate no noticeable head change. A radioactive-tracer, borehole-flow survey indicated that the two most productive zones in this borehole occurred in the upper part of the Bullfrog Member, depth interval from 721 to 731.5 meters, and in the underlying upper part of the Tram Member, depth interval from 864 to 920 meters, both in the Crater Flat Tuff. Hydraulic coefficients calculated from pumping-test data indicate that transmissivity ranged from 200 to 790 meters squared per day. The hydraulic conductivity ranged from 0.29 to 1.1 meters per day. Chemical analysis of water pumped from the saturated part of the borehole (composite sample) indicates that the water is typical of water produced from tuffaceous rocks in southern Nevada. The water is predominantly a sodium bicarbonate type with small concentrations of calcium, magnesium, and sulfate. The apparent age of this composite water sample was determined by a carbon-14 date to be 17,200 years before present. 24 refs., 10 figs., 8 tabs.

11041 **(WTSD-TME—2970) Stress control technique: its history and suitability for WIPP.** Kuhn, A.K. (Westinghouse Electric Corp., Carlsbad, NM (USA)). Dec 1979. Contract AC04-78AL05346. 21p. NTIS, PC A02. File Number DE86004317.

Bechtel has elected to recommend the SCT developed by Dr. Serata for a number of potash mines in Canada. The purpose of this report is to describe the SCT, provide a summary of experience with its applications as well as applications of other yield pillar techniques and draw conclusions resulting from these experiences. On first examination, one might conclude that the issue of the underground opening configuration could be resolved after the repository horizon has been reached from a shaft and underground experiments have been undertaken, thus avoiding any controversy at this time. The TSC could accept this type of approach and give tentative approval to the SCT design if we did not foresee the potential for major institutional and possibly technical ramifications of that approach. The reason for the high level of concern on TSC's part is twofold. The first major concern stems from the fact that throughout the rock mechanics, salt mechanics and salt mining communities, the SCT methodology is considered to be very controversial. The prevailing opinion is that the SCT can result in very serious mine stability and operational problems when it is applied to a geology where it is not suited. Expert consultants to the TSC, in addition to our own in-house staff, believe that the method should not be used for the WIPP. On that basis, it appears prudent to expect that when the SCT design is exposed to peer and public review, it will be highly criticized. It is very probable that such criticism could result in a substantial delay in the project, as well as a serious reduction in credibility of the overall design by the technical community.

11042 **(WTSD-TME—3106(Vol.1)) Ecosystem studies at the Los Medanos site, Eddy County, New Mexico. Volume I.** Hart, J.S. (ed.). (D'Appolonia Consulting Engineers, Albuquerque, NM (USA)). May 1981. Contract AC04-78AL05346. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004322.

This report summarizes the results of biological studies conducted during 1980 at the Los Medanos site in southeastern New Mexico. The studies include: (1) densities and species composition of the avifauna of the Los Medanos site; (2) aquatic ecosystems of the lower Pecos drainage; (3) floristic studies at the Los Medanos site; (4) plant successional, grazing, trampling, and salt studies on the Los Medanos site; (5) soil and vegetation studies at the Los Medanos site; (6) arthropod and decomposition studies at the WIPP site; (7) amphibians, reptiles and mammals at the Los Medanos site; (8) vertebrate ecology at the Los Medanos site; and (9) statistical analysis and data management. 7 refs. (ACR)

11043 (WTSD-TME—3106-Vol.2) Ecosystem studies at the Los Medanos site, Eddy County, New Mexico. Volume II. (Westinghouse Electric Corp., Carlsbad, NM (USA)). May 1981. Contract AC04-78AL05346. 454p. NTIS, PC A20/MF A01; 1; GPO Dep. File Number DE86004336.

This appendix contains the complete test of biological studies conducted during 1980 at the Los Medanos site in southeastern New Mexico. Separate abstracts were prepared for individual papers. (ACR)

11044 (WTSD-TME—3148) Basic data report: borehole WIPP-12 deepening. Waste Isolation Pilot Plant (WIPP) Project, southeastern New Mexico. Black, S.R. (D'Appolonia Consulting Engineers, Albuquerque, NM (USA)). Dec 1982. Contract AC04-78AL05346. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004343.

Borehole WIPP-12 was originally drilled in 1978 as an exploratory borehole to characterize the geology of the Waste Isolation Pilot Plant (WIPP) site in Eddy County, New Mexico. WIPP-12 was reentered and deepened in late 1981. WIPP-12 is located in Section 17, T22S, R31E, just outside the limit of Zone II, approximately one mile north of the exploratory shaft site. The deepening of WIPP-12 was undertaken for several reasons: to investigate the presence of an anticlinal or domal structure and thickening of halite indicated by surface seismic reflection surveys conducted in the area; to determine the nature and extent of deformation in the Castile Formation, in a location adjacent to the zone of anomalous seismic reflections found north of the well location ("Disturbed Zone"); and to characterize any fluid-bearing zones encountered in the Castile Formation while drilling. Field operations related to deepening of the borehole began November 16, 1981 and were completed January 1, 1982. The borehole was deepened through the Castile Formation to a total depth of 3927.5 ft by coring. Pressurized brine was encountered on November 22, 1981 at a depth of about 3016 ft. The brine reservoir is apparently related to a system of near-vertical fractures of unknown extent observed in Anhydrite III. The Halite I member is about 200 ft thicker than observed in undisturbed areas in the vicinity of WIPP (for example, Borehole DOE-1). Small-scale lithologic features such as folding of anhydrite stringers in halite and halite lineation appear to confirm the presence of a structural disturbance at this location. This Basic Data Report includes geologic information gathered during WIPP-12 deepening.

11045 (WTSD-TME—3159) Basic data report for borehole DOE-1. Waste Isolation Pilot Plant (WIPP) Project, Southeastern New Mexico. Freeland, M.H. (D'Appolonia Consulting Engineers, Albuquerque, NM (USA)). Sep 1982. Contract AC04-78AL05346. 138p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86004339.

Borehole DOE-1 is one of several exploratory boreholes drilled at the Waste Isolation Pilot Plant (WIPP) site for the purpose of gathering stratigraphic, hydrologic and structural data. DOE-1 is located in Zone III about 1.25 miles to the southeast of the exploratory shaft location. This project was undertaken for several reasons: to investigate the presence of an anticlinal structure in the Castile Formation indicated by seismic reflection surveys in the area; to gather data on the stratigraphy, structure and lithology of the rocks which comprise the facility horizon in an area immediately southeast of the facility itself; to test for the presence of gas or fluids in the rocks associated with the anticlinal structure, if present, or in the flat-lying rocks; and to determine the nature of the Castile Formation near the site, but outside the "Disturbed Zone". Field operations were initiated July 12, 1982 and completed July 30, 1982. The borehole was drilled to a depth of 4065.3 ft below kelly bushing, with approximately 420 ft of that interval cored. Where no core was taken, cuttings samples were collected and described at 10-ft intervals, largely for stratigraphic control and estimation of coring points. Data collected and observations made during drilling indicate that the lithology, stratigraphy and structure penetrated in DOE-1 are similar to that observed elsewhere in the WIPP vicinity. No brine or gas was noted, either by sensors at the wellhead or in trace amounts in the mud. Cored sections showed no structural disruption in the halite and anhydrite units of the Castile, other than minor, commonly observed folding and tilting of laminae in the anhydrites.

11046 Effects of α-radiolysis on leaching of a nuclear waste glass. Weber, W.J.; McVay, G.L.; Wald, J.W. (Pacific Northwest Laboratory, Richland, Washington). *Journal of the American Ceramic Society;* **68**: No. 9, C253-C255(Sep 1985).

The effects of α-radiolysis on leaching were studied in compositionally identical Pu-doped waste glass samples which were prepared at different α-activities (dose rates) by varying the $^{239}Pu/^{238}Pu$ isotopic ratio in the Pu dopant. The results of 14-, 28-, and 56-d static leach tests at 40°C, in both deionized water and brine solution, indicate that α-radiolysis at the sample/solution interface increased Pu and Si release by a factor of ≈ 3.

11047 Behavior of breached light water reactor spent fuel rods in air and inert atmospheres at 229°C. Einziger, R.E.; Cook, J.A. (Westinghouse Hanford Company, Richland, Washington). *Nuclear Technology;* **69**: No. 1, 55-71(Apr 1985).

A whole-rod test was conducted at 229°C to investigate the long-term stability of light water reactor spent fuel rods with artificially induced defects stored in inert and unlimited air atmospheres. Both boiling water reactor (BWR) and pressurized water reactor (PWR) rods were tested. After 2235 h, visual observations, diametral measurements, and radiographic smears were used to assess the degree of cladding deformation and particulate release. The same examinations plus metallography and x-ray analysis were conducted after 5962 h. Neither of the breached rods tested in inert atmosphere, nor the breached PWR rod tested in unlimited air, showed any measurable change from the pretest condition. The upper defect on the BWR rod tested in unlimited air had a 12.7-mm split after 2235 h and had 10% cladding deformation. The crack grew to 63.5 mm after 5962 h. X-ray analysis indicated that the UO_2 had oxidized to U_3O_8 at this defect. The difference in the behavior of the upper and lower defects is attributed to the accessibility of the air to the fuel due to the positioning of the defect with relation to the pellet/pellet interface.

11048 Initial results for the experimental evaluation of a nuclear waste repository source term model. McGrail, B.P.; Chick, L.A.; McVay, G.L. (Battelle Pacific Northwest Laboratory, Richland, Washington). *Nuclear Technology;* **69**: No. 1, 114-118(Apr 1985).

An initial series of experiments was performed to evaluate a near-field nuclear waste repository performance assessment model developed by P.L. Chambre, T.H. Pigford, and others at the University of California, Berkeley. Good agreement was found between the model and the experimental simulation at relatively high flow rates compared to those expected in an actual repository. At lower flow rates, surface mass transfer was enhanced over the model predictions due to an experimentally induced buoyancy mechanism.

11049 Management of TRU waste at the Idaho National Engineering Laboratory. Gertz, C.P. (U.S. Department of Energy, Idaho Falls, Idaho). *Nuclear Materials Management;* **13**: 14-20(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Since 1970, defense transuranic (TRU) waste has been placed into 20-year retrievable storage at the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory (INEL). A major objective of the U.S. Department of Energy (DOE) Nuclear Waste Management Program is to remove all retrievably stored TRU waste from the INEL. The INEL is currently developing, designing and constructing two facilities to demonstrate methods for retrieving, processing, and/or certifying the INEL stored TRU waste for shipment to, and experimental disposal demonstrations at, the Waste Isolation Pilot Plant (WIPP). Waste retrieval, nondestructive examination of waste containers, and certification of waste containers for shipment to the WIPP will be performed at the stored Waste Examination Pilot Plant (SWEPP). Waste containers that cannot be certified at SWEPP will be treated at the Process Experimental Pilot Plant (PREPP). The primary objective of PREPP is to demonstrate full-scale methods for processing the uncertifiable INEL stored TRU waste into a

form that meets the waste acceptance criteria at the WIPP. The initial experimental processing method will consist of lowspeed shredding for waste container opening and waste sizing, a rotary kiln for waste incineration, and waste immobilization by cementing.

11050 **Defense radioactive waste management activities: an overview.** D'Ambrosia, J.T. (U.S. Dept of Energy, Washington, DC). *Nuclear Materials Management;* **13**: 4-6(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Defense radioactive waste results from the Department of Energy's (DOE) national defense and research and development activities. These activities include: the operation of production reactors, fuel reprocessing plants and fabrication facilities which support the production of nuclear weapons; and the reprocessing of fuel from naval reactors. This paper describes the types of waste produced by these activities, some of the ongoing actions which assure that the existing waste is stored or disposed of safely, and outlines the planned future activities which will dispose of all DOE waste. The activities and facilities described assure that defense radioactive waste is safely managed: Low-level waste is being safely disposed; transuranic waste is being certified (and processed when necessary) in preparation for disposal; and high-level waste is being monitored to assure safe storage, and the processing and disposal facilities for this waste are being built or planned.

11051 **The radioactive waste disposal problem has a solution - the Waste Isolation Pilot Plant project.** Harmon, L.H. (U.S. Department of Energy, Washington, DC). *Nuclear Materials Management;* **13**: 21-24(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The Waste Isolation Pilot Plant (WIPP), now under development near Carlsbad, New Mexico, will provide a research and development facility to demonstrate the safe disposal of radioactive waste from national defense programs. WIPP is authorized by Public Law 96-164 and is exempted from licensing by the Nuclear Regulatory Commission. The primary objectives of WIPP are to demonstrate the technical and operational methods for permanent isolation of defense-generated radioactive waste, and to provide a facility for experiments on the behavior of high-level waste in bedded salt. The facility is designed to receive, inspect, emplace and store defense waste. It will have the capability of disposing of defense transuranic waste and conducting experiments with defense-generated high-level wastes. The construction of permanent surface and underground facilities started in July 1983 following an extensive exploratory program. This exploratory program included two large diameter shafts and mining over 2 miles of drifts (tunnels) to confirm the subsurface geology. Construction completion is scheduled for December 1986. Waste receiving operations are scheduled to begin by October 1988. WIPP is the Nation's first plant scale facility for geologic disposal of radioactive waste. Given its advanced state of design and construction (Title-II or final design was completed in February 1984), the WIPP project has much to say about a solution to the waste disposal problem. This paper provides an overview of the evolution and status of WIPP and how WIPP will demonstrate that geologic disposal of radwaste is indeed feasible.

11052 **Implementation status of NWPA requirements and relevant activities of the repository projects.** Hewitt, W.M.; Friedman, P.L. (Weston NWTS Technical Support Team, Rockville, Maryland). *Nuclear Materials Management;* **13**: 226-231(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

To date, the Department of Energy (DOE) has focussed considerable effort on implementing the provisions of the Nuclear Waste Policy Act of 1982 (NWPA) for screening, nominating, and recommending sites for geologic repositories and for preparation of documents reflecting DOE's repository strategy. In February 1983, nine potentially acceptable sites in three different geologic media (salt, tuff, basalt) were identified. DOE has prepared Siting Guidelines and submitted them to the Nuclear Regulatory Commission for concurrence. Preparation of draft environmental assessments (EAs) based on the guidelines to support site nominations is underway; the EAs are expected to be issued for public comment in August 1984. The final EAs which are scheduled to be issued in December 1984 will provide the basis for the recommendation of three sites to the President for site characterization by January 1985, the date mandated by the NWPA. In April 1984, the draft Mission Plan was issued for public comment. The plan discusses repository program objectives and overall strategy and presents the detailed information required by Section 301 of the NWPA. The DOE is also developing a Project Decision Schedule which will reflect the Mission Plan schedules as well as provide a sequence of deadlines for all Federal agency actions required by the NWPA and identify the critical path for repository development.

11053 **BNL high-level waste technical assistance programs for support of the NRC.** Davis, M.S.; Schweitzer, D.G. (Brookhaven National Laboratory, Upton, NY). *Nuclear Materials Management;* **13**: 236-240(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

This paper summarizes past and present recommendations of the Brookhaven National Laboratory Waste Management Staff to the Nuclear Regulatory Commission on both generic and priority issues needed to predict waste package performance after repository closure.

11054 **Objective of the NRC high-level research program at BNL.** Schweitzer, D.G.; Comella, P.; Davis, M.S. (Brookhaven National Lab., Upton, NY). *Nuclear Materials Management;* **13**: 241-242(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The NRC supports research in the area of high-level waste to help provide the information and assessments necessary to license a HLW repository. The criteria used by the Office of Nuclear Regulatory Research to identify projects for HLW include: development of expertise in unfamiliar technologies needed to evaluate the phenomena, mechanisms and uncertainties associated with the NRC and EPA criteria and other issues required in licensing: development of capabilities needed to audit tests and analyses of DOE work used to demonstrate compliance; and development of regulatory tools (regulation guides, design criteria, standards, technical positions, etc.) needed to understand models and uncertainties and to provide guidance to the DOE on the information needed for compliance assessment. The NRC supports research in the areas of both "far-field" and "near-field". Compliance with the EPA criterion and the NRC groundwater travel time criterion depend heavily on "far-field" properties whereas compliance with the containment and controlled release criteria depend upon "near-field" properties. The waste package plays the sole role in compliance with the containment criterion and a major role in determining controlled release from the engineered barrier system. BNL's past and present research programs have involved an evaluation of container failure modes not considered by the DOE in their preliminary waste package designs.

11055 **Progress toward the second respository--status.** Heinemann, R.E. (Office of Crystalline Repository Development, Battelle Project Management Division, Columbus, OH). *Nuclear Materials Management;* **13**: 243-248(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The U.S. Department of Energy (DOE) is investigating the suitability of a variety of geologic media for siting two permanent, nuclear waste repositories in accordance with the provisions of the Nuclear Waste Policy Act (NWPA) of 1982. The Crystalline Repository Project (CRP) is one of four projects under DOE's Civilian Radioactive Waste Management Program. The objective of the CRP is to evaluate, screen, and recommend sites in crystalline rocks for construction of the second repository. After completing a national survey of crystalline rocks, three regions in seventeen states were selected by DOE for further evaluation. Rock bodies in these regions will be screened to a smaller number of areas in 1985. The NWPA requires that three sites for the second repository be

recommended to the President for site characterization by July 1989. The background, current status, and nearterm future activities of the CRP are described.

11056 **Alternatives and optimization of the waste management system.** Dippold, D.G.; Wampler, J.A. (Battelle Project Management Division, Columbus, Ohio). *Nuclear Materials Management;* **13**: 249-256(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The design of the nuclear waste management system involves numerous choices among competing alternatives. Choosing the optimum alternative, however, is often difficult because of complicated tradeoffs. System models and the use of certain decision rules can aid designers in making these choices. One such system model, WADCOM II: A Waste Disposal Cost Model, is described and used, along with a "minimax" decision rule, to illustrate how one might select an optimum waste package alternative.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 11000, 11025, 11026, 11030, 11037, 11042, 11043, 11048, 11074, 11559, 11722

11057 **(CEA-CONF—7900) Experimentation and modelling of U, Th, and lanthanides transport in fissured rocks. Influence of complexation.** Toulhoat, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1985. 4p. (CONF-850995—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750378.

From Materials Research Society international symposium; Stockholm, Sweden (9 Sep 1985).

A circulation between two drill holes in a granite after hydraulic fracturation (site INAG, le Mayet de Montagne, France) is experimented. $UO_2(CO_3)_3^{4-}$ and Th, La, Sm, Eu, Dy and Yb EDTA complexes are injected together. Different amounts of tracers are also injected successively. Break through curves are similar for Th and lanthanides, but somewhat different for U that shows increasing tailing. Recovery rates increase with increasing stability of the complex (41.4% for La to 96.7% for Yb in the third run) and with increasing amount of tracer. To account for indications of non-linearity, a Freundlich isotherm: F=K.Csup(1/2), C= complexed tracer concentration in the fluid, F= tracers concentration adsorbed on the solid, K= global sorption constant, is used for EDTA tracer sorption. The experiments have demonstrated the importance of complexation and its consequence (non-linearity) when experimenting and modelling elements transport.

11058 **(CONF-8509121—26) Development and applications of two finite element groundwater flow and contaminant transport models: FEWA and FEMA.** Yeh, G.T.; Wong, K.V.; Craig, P.M.; Davis, E.C. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005149.

From 7. annual DOE LLWMP participants information meeting; Las Vegas, NV, USA (10 Sep 1985).

This paper presents the construction, verification, and application of two groundwater flow and contaminant transport models: A Finite Element Model of Water Flow through Aquifers (FEWA) and A Finite Element Model of Material Transport through Aquifers (FEMA). The construction is based on the finite element approximation of partial differential equations of groundwater flow (FEWA) and of solute movement (FEMA). The particular features of FEWA and FEMA are their versatility and flexibility for dealing with nearly all vertically integrated two-dimensional problems. The models were verified against both analytical solutions and widely used US Geological Survey finite difference approximations. They were then applied for calibration and validation, using data obtained in experiments at the Engineering Test Facility at Oak Ridge National Laboratory. Results indicated that the models are valid for this specific site. To demonstrate the versatility anf flexibility of the models, they were applied to two hypothetical, but realistic, complex problems and three field sites across the United States. In these applications the models yielded good agreement with the field data for all three sites. Finally, the predictive capabilities of the models were demonstrated using data obtained at the Hialeah Preston site in Florida. This case illustrates the capability of FEWA and FEMA as predictive tools and their usefulness in the management of groundwater flow and contaminant transport. 25 refs.

11059 **(LBL—20166) Reliable predictions of waste performance in a geologic repository.** Pigford, T.H.; Chambre, P.L. (Lawrence Berkeley Lab., CA (USA)). Aug 1985. Contract AC03-76SF00098. 26p. (CONF-850918—9). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005213.

From International topical meeting on high level nuclear waste disposal - technology and engineering; Pasco, WA, USA (24 Sep 1985).

Establishing reliable estimates of long-term performance of a waste repository requires emphasis upon valid theories to predict performance. Predicting rates that radionuclides are released from waste packages cannot rest upon empirical extrapolations of laboratory leach data. Reliable predictions can be based on simple bounding theoretical models, such as solubility-limited bulk-flow, if the assumed parameters are reliably known or defensibly conservative. Wherever possible, performance analysis should proceed beyond simple bounding calculations to obtain more realistic - and usually more favorable - estimates of expected performance. Desire for greater realism must be balanced against increasing uncertainties in prediction and loss of reliability. Theoretical predictions of release rate based on mass-transfer analysis are bounding and the theory can be verified. Postulated repository analogues to simulate laboratory leach experiments introduce arbitrary and fictitious repository parameters and are shown not to agree with well-established theory. 34 refs., 3 figs., 2 tabs.

11060 **(PNL-SA—12879) Results from the long-term interaction and modeling of SRL-131 glass with aqueous solutions.** Strachan, D.M.; Pederson, L.R.; Lokken, R.O. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1985. Contract AC06-76RL01830. 9p. (CONF-850995—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004867.

From Materials Research Society international symposium; Stockholm, Sweden (9 Sep 1985).

Leaching studies of SRL-131 simulated defense nuclear waste glass have been carried out to two years duration, in leachants that simulate groundwaters of different ionic strengths. The leachability of SRL-131 glass followed the trend: deionized water > silicate water > salt brine = simulated groundwater at 40°C and deionized water = simulated groundwater > silicate water > salt brine at 90°C. The results are in general agreement with calculations using the PHREEQE geochemical code and indicate a sometimes complex sequence temperature dependent of mineral precipitation and redissolution. The calculations done in this study have illustrated the complexity of the precipitation sequence of mineral phases as a function of reaction progress. Complex, temperature dependent, precipitation/dissolution sequences have also been observed in experiments using natural materials, such as sea water and basaltic glass. The results of this two-year study point to the need for further work in establishing the thermodynamics of the observed phases and the relationship of these phases to the thermodynamically favored suite of phases for any given waste form/host rock/groundwater system. In order to study these phases, very long-term experiments may be necessary so that the phases grow to sizes which can be studied. In addition, geochemical codes should be used to better understand the experiments, to design leach test matrices, and to help predict the long-term results of experiments. The combination of long-term experiments and geochemical codes should lead to an improved method for forecasting the long-term behavior of a nuclear waste repository. 15 refs., 3 figs., 4 tabs.

11061 **(SAND—85-0380) Workshop on the source term for radionuclide migration from high-level waste or spent nuclear fuel under realistic repository conditions: proceedings.** Hunter, T.O.; Muller, A.B. (eds.). (Nuclear Energy Agency, 75 - Paris (France)). Jul 1985. Contract AC04-76DP00789. 203p. (CONF-8411160—). NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85016832.

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

Sixteen papers were presented at the workshop. The fourteen full-length papers included in the proceedings were processed separately. Only abstracts were included for the following two papers: Data Requirements Based on Performance Assessment Analyses of Conceptual Waste Packages in Salt Repositories, and The Potential Effects of Radiation on the Source Term in a Salt Repository. (LM)

11062 (SAND—85-0380, pp 29-40) **Importance of the source term for the release of radionuclides from a repository in a salt dome.** Stelte, N.; Storck, R. (Institut fuer Tieflagerung, Braunschweig, Germany). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

The release of radionuclides from a backfilled and brine saturated repository in a salt dome is analyzed as a function of canister lifetimes and solubility limits. The relationship between the waste package and the multi-barrier system of the repository is discussed.

11063 (SAND—85-0380, pp 41-68) **Source term modelling in the Swedish KBS - 3 study.** Neretnieks, I. (Royal Inst. of Technology, Stockholm, Sweden). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

The release rate of the individual nuclides from spent fuel in a deep geologic repository in crystalline rock is modelled. After canister breakdown when the fuel is wetted and starts to dissolve, the released nuclides migrate out into and through the backfill. The backfill, which consists of a compacted bentonite clay, has low permeability and effectively permits transport by diffusion only. The clay has strong sorptive capacity for most nuclides and retards their movement through the barrier. Many of the shorter lived nuclides ^{241}Am, ^{137}Cs, ^{90}Sr, and ^{240}Pu decay considerably during their passage of the buffer. The longer lived nuclides will eventually be released to the outside of the buffer without significant decay. During the ensuing semi-stationary phase the release rate will be determined by the dissolution rate of the uranium oxide matrix and the congruent release of the other nuclides. The dissolution rate of the uranium oxide is determined by its solubility and the various diffusion barriers between the fuel and the flowing water. These consist of clay backfill, possibly the clay which has intruded into the fissures and the slowly moving water in the fissures. The transport in the various barriers has been modelled. The dominating resistance in the cases studied was located in the slowly moving water in the narrows fissures. The situation is somewhat complicated by radiolysis which may give rise to an oxidizing environment nearest to the fuel. This increases the solubility of many important species and increases the release rates. The escaping oxidized species and the oxidizing agents themselves will move out into the rock where they will react with divalent iron minerals in the rock. At the sharp redox front which develops within a few meters (to maximum a few tens of meters) downstream from the canisters, the redox sensitive elements precipitate.

11064 (SAND—85-0380, pp 69-80) **Source-term considerations for a potential radioactive-waste repository located in unsaturated tuff.** Braithwaite, J.W.; Tierney, M.S. (Sandia National Labs., Albuquerque, NM). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

The Nevada Nuclear Waste Storage Investigations project is studying the feasibility of locating a repository for high-level radioactive waste in the unsaturated tuffs at Yucca Mountain near the southwest part of the Nevada Test Site. An important part of these studies is the formulation of physically appropriate source terms for use in mathematical models used to assess the performance of the potential repository. Performance assessments conducted to date have used a preliminary source term based on simple assumptions and currently available data; this source term is described, along with the results of a sensitivity study that show the important parameters affecting the time-dependent radionuclide release rates. 7 refs., 1 tab.

11065 (SAND—85-0380, pp 115-124) **Quantification of source-term profiles from near-field geochemical models.** McKinley, I.G. (Eidg. Institut fuer Reaktorforschung, Wuerenlingen, Switzerland). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

A geochemical model of the near-field is described which quantitatively treats the processes of engineered barrier degradation, buffering of aqueous chemistry by solid phases, nuclide solubilization and transport through the near-field and release to the far-field. The radionuclide source-terms derived from this model are compared with those from a simpler model used for repository safety analysis. 10 refs., 2 figs., 2 tabs.

11066 (SAND—85-0380, pp 125-136) **Conceptual model for repository source-term evaluation.** Apted, M.J.; Alexander, D.H.; Liebetrau, A.M.; Van Luik, A.E.; Williford, R.E.; Doctor, P.G. (Pacific Northwest Lab., Richland, WA; Department of Energy, Washington, DC; Weston Consultants, Rockville, MD). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

A new source-term model is described that will yield probabilistically determined estimates of the times-to-penetration by various corrosion mechanisms for metallic barriers of waste packages. After penetration, the model evaluates radionuclide release rates as a function of groundwater hydrology, dissolution/precipitation reactions, sorption processes, inventory changes, and variations in the geochemical/radiation environment. Integrated repository releases will be calculated over time by summing the probabilistically generated releases from the individual waste packages. 24 refs., 5 figs.

11067 (SAND—85-0380, pp 139-150) **System tests for studying the release of radioactivity from high-level waste forms under geological disposal conditions.** Gray, M.N.; Heimann, R.B.; Tait, J.C.; Wikjord, A.G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

Canadian studies are focused on a multibarrier concept of disposing of high-level wastes in plutonic rock. There has been considerable effort to specify the components of the underground vault and the physical, geochemical, mechanical and radiological conditions of the disposal environment. The postclosure assessment of the disposal concept requires a reliable prediction of the flux of radionuclides from the vault to the geosphere as a function of time. This paper describes the multicomponent system tests and facilities designed to determine the performance of the engineered barriers of the vault under geological disposal conditions. 16 refs., 8 figs., 2 tabs.

11068 (SAND—85-0380, pp 163-174) **Laboratory simulation of radionuclide geological migration.** Avogadro, A.; Bidoglio, G.; Saltelli, A. (Commission of the European Communities, Ispra, Italy). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

The quantitative description of radionuclide migration in the geosphere demands that the physico-chemical characteristics of species released from the source term are considered. Laboratory experiments which allowed the identification of the migration mecha-

nisms involved are described; the physical model adopted corresponds to porous media permeated with fresh and/or saline ground water. The waste form considered is the vitrified high level waste, and problems connected with the transport of colloidal as well as of soluble species are discussed following a theoretical and experimental approach. 4 refs., 10 figs., 2 tabs.

11069 (SAND—85-0380, pp 175-186) **Laboratory experiments designed to provide limits on the radionuclide source term for the NNWSI project.** Oversby, V.M.; McCright, R.D. (Lawrence Livermore National Lab., CA). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

The Nevada Nuclear Waste Storage Investigations Project is investigating the suitability of the tuffaceous rocks at Yucca Mountain, Nevada for potential use as a high-level nuclear waste repository. The horizon under investigation lies above the water table, and therefore offers a setting that differs substantially from other potential repository sites. The unsaturated zone environment allows a simple, but effective, waste package design. The source term for radionuclide release from the waste package will be based on laboratory experiments that determine the corrosion rates and mechanisms for the metal container and the dissolution rate of the waste form under expected long-term conditions. This paper describes the present status of laboratory results and outlines the approach to be used in combining the data to develop a realistic source term for release of radionuclides from the waste package. 16 refs., 3 figs., 1 tab.

11070 **Sampling, characterization, and remote sensing of aerosols formed in the atmospheric hydrolysis of uranium hexafluoride.** Bostick, W.D.; McCulla, W.H.; Pickrell, P.W. (Oak Ridge Gaseous Diffusion Plant, TN). *Journal of Environmental Science and Health, Part A: Environmental Science and Engineering;* **A20**: No. 3, 369-393(1985). Contract AC05-84OR21400.

When gaseous uranium hexafluoride (UF_6) is released into the atmosphere, it rapidly reacts with ambient moisture to form an aerosol of uranyl fluoride (UO_2F_2) and hydrogen fluoride (HF). As part of their Safety Analysis program, the authors have performed several experimental releases of UF_6 in contained volumes in order to investigate techniques for sampling and characterizing the aerosol materials. The aggregate particle morphology and size appear to be dependent upon several conditions, including the relative humidity of the air into which it is released, and the elapsed time after the release. Aerosol composition and settling rate have been investigated using stationary samplers for the separate collection of UO_2F_2 and HF, and via laser spectroscopic remote sensing (Mie scatter and infrared spectroscopy).

11071 **Environmental assessment of repository sites considerations and methodology.** McIntosh, W.H. (Office of Nuclear Waste Isolation, Battelle Project Management Division, Columbus, Ohio). *Nuclear Materials Management;* **13**: 232-235(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Public Law 97-425, the Nuclear Waste Policy Act of 1982, "the Act," established a process by which sites for repositories will be identified and selected. The process involves nominating sites for further study, studying those sites, then recommending one as the location for the nation's first repository for disposal of high-level nuclear waste. An Environmental Assessment (EA) is required by the Act to provide the basis upon which the Secretary of the Department of Energy will nominate and recommend sites for the several years of further studies which must precede the decision of which site is to be the location of the first repository. The DOE is preparing EAs for each of seven salt sites in Louisiana, Mississippi, Texas, and Utah, and for tuff and basalt sites in Washington and Nevada. These EAs will evaluate sites against DOE guidelines, also developed under authority of the Act. This paper describes the evaluations the EA must contain to be responsive to the Act and the DOE guidelines.

0540 Health And Safety

REFER ALSO TO CITATION(S) 11002, 11003, 11026, 11037

11072 **(DOE/AL/05346—T6-Vol.1) Waste Isolation Pilot Plant Safety Analysis Report. Volume 1.** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). [1986]. Contract AC04-78AL05346. 467p. NTIS, PC A20/MF A01; 1; GPO Dep. File Number DE86004908.

This Safety Analysis Report (SAR) has been prepared by the US Department of Energy (DOE) to support the construction and operation of the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico. The WIPP facility is designed to receive, inspect, emplace, and store unclassified defense-generated transuranic wastes in a retrievable fashion in an underground salt medium and to conduct studies and perform experiments in salt with high-level wastes. Upon the successful completion of these studies and experiments, WIPP is designed to serve as a permanent facility. The first chapter of this report provides a summary of the location and major design features of WIPP. Chapters 2 through 5 describe the site characteristics, design criteria, and design bases used in the design of the plant and the plant operations. Chapter 6 discusses radiation protection: Chapters 7 and 8 present an accident analysis of the plant and an assessment of the long-term waste isolation at WIPP. The conduct of operations and operating control and limits are discussed in Chapters 9 and 10. The quality assurance programs are described in Chapter 11.

11073 **(DOE/AL/05346—T6-Vol.2) Waste Isolation Pilot Plant Safety Analysis Report. Volume 2.** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). [1986]. Contract AC04-78AL05346. 552p. NTIS, PC A24/MF A01; 1; GPO Dep. File Number DE86004909.

This Safety Analysis Report (SAR) has been prepared by the US Department of Energy (DOE) to support the construction and operation of the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico. The WIPP facility is designed to receive, inspect, emplace, and store unclassified defense-generated transuranic wastes in a retrievable fashion in an underground salt medium and to conduct studies and perform experiments in salt with high-level wastes. Upon the successful completion of these studies and experiments, WIPP is designed to serve as a permanent facility. The first chapter of this report provides a summary of the location and major design features of WIPP. Chapters 2 through 5 describe the site characteristics, design criteria, and design bases used in the design of the plant and the plant operations. Chapter 6 discusses radiation protection; Chapters 7 and 8 present an accident analysis of the plant and an assessment of the long-term waste isolation at WIPP. The conduct of operations and operating controls and limits are discussed in Chapters 9 and 10. The quality assurance programs are described in Chapter 11.

11074 **(DOE/AL/05346—T6-Vol.3) Waste Isolation Pilot Plant Safety Analysis Report. Volume 3.** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). [1986]. Contract AC04-78AL05346. 481p. NTIS, PC A21/MF A01; 1; GPO Dep. File Number DE86004912.

This Safety Analysis Report (SAR) has been prepared by the US Department of Energy (DOE) to support the construction and operation of the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico. The WIPP facility is designed to receive, inspect, emplace, and store unclassified defense-generated transuranic wastes in a retrievable fashion in an underground salt medium and to conduct studies and perform experiments in salt with high-level wastes. Upon the successful completion of these studies and experiments, WIPP is designed to serve as a permanent facility. The first chapter of this report provides a summary of the location and major design features of WIPP. Chapters 2 through 5 describe the site characteristics, design criteria, and design bases used in the design of the plant and the plant operations. Chapter 6 discusses radiation protection; Chapters 7 and 8 present an accident analysis of the plant and an assessment of the long-term waste isolation at WIPP. The conduct of operations and operating controls and limits are discussed in Chapters 9 and 10. The quality assurance programs are described in Chapter 11.

11075 **(DOE/AL/05346—T6-Vol.4) Waste Isolation Pilot Plant Safety Analysis Report. Volume 4.** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). [1986]. Contract AC04-78AL05346. 407p. NTIS, PC A18/MF A01; 1; GPO Dep. File Number DE86004911.

This Safety Analysis Report (SAR) has been prepared by the US Department of Energy (DOE) to support the construction and operation of the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico. The WIPP facility is designed to receive, inspect, emplace, and store unclassified defense-generated transuranic wastes in a retrievable fashion in an underground salt medium and to conduct studies and perform experiments in salt with high-level wastes. Upon the successful completion of these studies and experiments, WIPP is designed to serve as a permanent facility. The first chapter of this report provides a summary of the location and major design features of WIPP. Chapters 2 through 5 describe the site characteristics, design criteria, and design bases used in the design of the plant and the plant operations. Chapter 6 discusses radiation protection; Chapters 7 and 8 present an accident analysis of the plant and an assessment of the long-term waste isolation at WIPP. The conduct of operations and operating controls and limits are discussed in Chapters 9 and 10. The quality assurance programs are described in Chapter 11.

11076 **(DOE/AL/05346—T6-Vol.5) Waste Isolation Pilot Plant Safety Analysis Report. Volume 5.** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). [1986]. Contract AC04-78AL05346. 466p. NTIS, PC A20/MF A01; 1; GPO Dep. File Number DE86004910.

This Safety Analysis Report (SAR) has been prepared by the US Department of Energy (DOE) to support the construction and operation of the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico. The WIPP facility is designed to receive, inspect, emplace, and store unclassified defense-generated transuranic wastes in a retrievable fashion in an underground salt medium and to conduct studies and perform experiments in salt with high-level wastes. Upon the successful completion of these studies and experiments, WIPP is designed to serve as a permanent facility. The first chapter of this report provides a summary of the location and major design features of WIPP. Chapters 2 through 5 describe the site characteristics, design criteria, and design bases used in the design of the plant and the plant operations. Chapter 6 discusses radiation protection; Chapters 7 and 8 present an accident analysis of the plant and an assessment of the long-term waste isolation at WIPP. The conduct of operations and operating controls and limits are discussed in Chapters 9 and 10. The quality assurance programs are described in Chapter 11.

11077 **(INFO—0100) Recommendations concerning an interim annual individual exposure limit for respirable quartz.** Stocker, H.; Horvath, F.J.; Napier, W. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jul 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700487.

This paper presents AECB staff recommendations on the desirability of an annual individual occupational exposure limit for respirable quartz and on the magnitude of this limit, for uranium miners. Justifications are presented for the magnitude of this suggested limit for respirable quartz, drawing on experience gained in Ontario uranium and non-uranium mines and on that in other countries. The suggestion is made that an exposure limit be set for an interim period in order that additional information on the adequacy of the magnitude of the limit may be acquired. To complement the suggested exposure limit, it is proposed that a co-existing control program of action levels, to be triggered at various respirable quartz concentrations, be set up. It is the contention of this paper that the degree of protection afforded to individuals by the suggested exposure limit would be equivalent to the time-weighted average threshold limit value derived from recommendations, based on group average exposures, of the American Conference of Governmental Industrial Hygienists.

11078 **(NUREG/CR—4360-Vol.2) Calculational methods for analysis of postulated UF_6 releases. Volume 2.** Williams, W.R. (Oak Ridge National Lab., TN (USA)). Sep 1985. Contract AC05-84OR21400. 210p. (ORNL/ENG/TM—31-V2). NTIS, PC A10/MF A01 - GPO. File Number TI86002985.

Volume 2 comprises three appendices: listings of main programs; listings of subroutines; and example problem output.

11079 **(RHO-WM-EV—9-P) Hydrogen control in the handling, shipping and storage of wet radioactive waste.** Henrie, J.O.; Flesher, D.J.; Quinn, G.J.; Greenborg, J. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Dec 1985. Contract AC06-77RL01030. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005235.

To ensure that flammable gas mixtures will not exist in canisters planned for the transport of TMI-2 core debris, Rockwell Hanford Operations conducted a demonstration test program to determine which catalysts and bed configurations would be acceptable and near optimum under wet conditions. These studies demonstrated the simplicity and effectiveness of catalytic recombination of hydrogen and oxygen, even under very wet conditions. The stoichiometric reaction of these gases in the container atmosphere maintains the minimum constituent (either hydrogen or oxygen) below 1%, and ensures that flammable mixtures (>4.1% H_2 and 5.0% O_2) will not be attained. The US Nuclear Regulatory Commission Office of Inspection and Enforcement (I & E) has established requirements for the shipment of waste materials subject to hydrogen gas generation. This I & E notice establishes a safe-shipping time period that is twice the expected shipping and handling period to ensure safety during shipment. Hydrogen and oxygen concentrations "must be determined by tests and measurement or by analysis of a representative package." The concentration of hydrogen gas must be limited to 5% by volume or the concentration of oxygen gas must be limited to 5% by volume. This document is intended to convey the pertinent information concerning the handling and shipping of wet radioactive wastes which resulted from the TMI-2 experience. It provides engineering tools, procedures, and precautions that are intended to ensure the safe handling, shipping and storage of wet radioactive wastes. A step-wise procedure is presented that permits the individual investigator to evaluate the potential for flammable gas generation, and to minimize potential hazards, with the intent of meeting the referenced NRC requirements. 21 refs., 10 figs., 6 tabs.

0550 Regulations

REFER ALSO TO CITATION(S) 10982, 10992, 11260, 11264, 11611, 11721, 11840

11080 **(CEA-CONF—7684) Measurement methods of alpha activity in nuclear wastes: gamma spectrometry, detection of fission neutrons.** Cance, M.; Bady, N. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Nov 1984. 27p. (In French). (CONF-8411210—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE86750385.

From 13. congress of the Association for Radiation Protection Science and Technology; Strasbourg, France (6 Nov 1984).

A synthesis of methods for alpha activity determination of nuclear wastes in 200-liter drums is presented. A high resolution gamma spectrometry station, allowing a threshold detection around 100 mg of ^{239}Pu, is described. First results on the detection of prompt neutrons produced by impulses of thermalized 14-MeV neutrons are presented.

11081 **(DOE/NBM—6005390) Managing the nation's nuclear waste. Overview: Nuclear Waste Policy Act.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Oct 1985. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005390.

Signed into law by the President on January 7, 1983, the Nuclear Waste Policy Act established a national policy for safely storing, transporting, and disposing of spent nuclear fuel and high-level radioactive waste. This overview presents the following informa-

tion on the Nuclear Waste Policy Act: (1) background; (2) permanent repository; (3) siting guidelines and mission plan; (4) monitored retrievable storage; and (5) nuclear waste funds. (DT)

11082 **(ORNL/M—111) Investigation report of the release of strontium-90 from the Building 3517 cell ventilation improvements construction site on November 29, 1985, Oak Ridge National Laboratory, Oak Ridge, Tennessee.** (Oak Ridge National Lab., TN (USA)). 21 Jan 1986. Contract AC05-84OR21400. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005278.

This Type B Investigative Report provides an evaluation of all relevant events and activities that led to, were an integral part of, and subsequently resulted from ORNL's November-December 1985 strontium-90 release incident. The impacts were evaluated in terms of radiological doses to ORNL and Rust employees associated with the incident, ORGDP employees who consumed potable water potentially impacted by the incident, and Kingston, Tennessee, residents who also consumed potable water potentially impacted by the incident; and in terms of reductions in ORNL's low-level liquid radioactive waste storage capabilities. The management systems evaluated include: (1) those intended to reduce the potential of occurrence of such events and (2) those intended to provide adequate response to such events should they occur. Inherent in the management system evaluations were reviews of applicable planning activities and intra- and inter-organization communications. The composition of the investigation board and its appointment are contained in Appendix 1. 2 figs., 1 tab.

11083 **(SAND—85-7260) Insurance-indemnity coverage for nuclear transportation: an overview.** Brown, O.F. II. (Brown (Omer F. II), Washington, DC (USA)). Jan 1986. Contract AC04-76DP00789. 39p. (TTC—0607). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004224.

This report provides a comprehensive overview of insurance-indemnity coverage for various nuclear transportation activities. It examines public liability coverage under the present provisions of the Price-Anderson Act, liability insurance policies issued by the nuclear insurance pools, conventional liability insurance policies containing the "Broad Form Nuclear Energy Liability Exclusion Endorsement", and Public Law 85-804. It also outlines (in the appendix) some of the issues Congress has been considering for the last two years in deciding whether to extend the Price-Anderson Act beyond its present 1987 expiration. The report's description of liability coverage for nuclear transportation activities depends to a very large extent upon the Price-Anderson Act, whose authority for new coverage expires in less than two years (on August 1, 1987). With no other comparable coverage available now or in the foreseeable future, transporters and others need to monitor Congressional activities to determine whether the Price-Anderson Act will or will not be extended in substantially its present form.

11084 **(SRDP-R—119) Comparison of retrospective testing with statistical tests in near real time materials accountancy.** Russell, N.S.; Butterfield, M.H.; Howell, J. (UKAEA Atomic Energy Research Establishment, Harwell. Safeguards R and D Project; Southampton Univ. (UK); UKAEA Atomic Energy Establishment, Winfrith). Oct 1984. 11p. (AEEW-R—1878). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701203.

This report is concerned with the subject of nuclear materials accountancy. Currently, statistical tests for an abrupt loss assume the loss occurs on the last balance formed. The ability to detect such a loss can be significantly improved by considering that a diversion occurred on the previous period. Further improvements can be made by considering the diversion on even earlier periods. A new test (REMUF) is developed to achieve this. Practical implications are considered providing alternative options. The sensitivities of the principal well established tests as well as the one proposed in this paper are compared. This comparison is made both for abrupt and protracted losses.

11085 **Safeguards and security design guidelines for conceptual Monitored Retrievable Storage (MRS) facilities.** Byers, K.R.; Clark, R.G.; Harms, N.L.; Roberts, F.P. (Pacific Northwest Laboratory Richland, Washington). *Nuclear Materials Management;* **13**: 257-263(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Existing safeguards/security regulations and licensing requirements that may be applicable to an MRS facility are not currently well-defined. Protection requirements consistent with the NRC-graded safeguards approach are identified, as a baseline safeguards system with a comparison of the impacts on safeguards and security of salient features of the different storage concepts. In addition, MRS facility design features and operational considerations are proposed that would enhance facility protection and provide additional assurance that protection systems and procedures would be effectively implemented.

11086 **A portable nondestructive assay measurement control system.** Palmer, M.E. (Rockwell Hanford Operations, Richland, Washington). *Nuclear Materials Management;* **13**: 29-31(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Portable nondestructive assay (NDA) of plutonium processing hoods, solvent extraction columns, glove boxes, filters, and other items is required for both nuclear materials accountability and criticality control purposes. The Plutonium Finishing Plant has hundreds of such items that require routine portable NDA measurement. Previous recordkeeping of NDA measurements consisted of boxes of papers containing results and notebooks containing notes for each item to be measured. If the notes for any item were lost, new measurement parameters had to be calculated for that item. As a result, subsequent measurements could no longer be directly compared with previous results for that item due to possible changes in measurement parameters. The new portable NDA management system keeps all the necessary information in a computerized data base. Technicians are provided with a computer-generated drawing of each item to be measured, which also contains comments, measurement points, measurement parameters, and a form for filling in the raw data. After the measurements are made, the technician uses the computer to calculate and print out the results.

11087 **Calibration of an NDA neutron monitor for determining process holdup.** Doerr, R.W.; Nicaise, W.F. (Rockwell Hanford Operations, Energy Systems Group, Richland, Washington). *Nuclear Materials Management;* **13**: 42-47(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Material holdup in chemical processing lines and equipment creates problems for special nuclear material accountability. A prototype neutron monitor has been built at Los Alamos National Laboratory (Los Alamos) to criteria provided by Rockwell Hanford Operations (Rockwell). The design of this prototype neutron monitor is based on the existing High-Level Neutron Coincidence Counter (HLNCC) technology developed at Los Alamos for use in the nuclear industry. In the present Rockwell application the HLNCC has been adapted for use as an NDA monitor for end-of-campaign calciner holdup measurements within a reprocessing facility. The design and theory of operation of the monitor are briefly discussed. The operating characteristics of the neutron monitor have been observed in detail and are described. Results of in-place calibration of the neutron monitor and the expected quality of NDA measurements that will be made with the monitor are presented.

11088 **Estimation methods for special nuclear materials holdup.** Pillay, K.K.S.; Picard, R.R. (Los Alamos National Laboratory, Los Alamos, NM). *Nuclear Materials Management;* **13**: 60-65(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The potential value of statistical models for the estimation of residual inventories of special nuclear materials was examined using

holdup data from processing facilities and through controlled experiments. Although the measurement of hidden inventories of special nuclear materials in large facilities is a challenging task, reliable estimates of these inventories can be developed through a combination of good measurements and the use of statistical models.

11089 **Valve monitor designs for security applications.** Curlee, R.M.; Magan, D.L. (Sandia National Laboratories, Albuquerque, NM). *Nuclear Materials Management;* **13**: 306-309(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

With the advent of system concepts to protect against sabotage by an insider, the capability to reliably provide, in a tamper-safe way, information on the state of critical valves is gaining more attention. Several different technological types of valve monitors have been developed and have undergone testing in an operational environment. Some typical designs of monitors, which are based on microswitch, photoelectric, balanced magnetic switch, and magnetoresistive sensor techniques, are described, and the test results these monitors recorded are discussed.

11090 **Resolving MC & A alarms from process monitoring in a fuel fabrication facility.** Smith, B.W.; Razvi, J. (Pacific Northwest Laboratory, Richland, WA). *Nuclear Materials Management;* **13**: 322-329(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Process monitoring data can be used for generating material loss estimates. The intent of using process control data is to enhance nuclear material control and accounting for the timely detection and resolution of discrepancies. The purpose of an alarm resolution system is to distinguish between system errors and an actual loss of nuclear material. A study has been performed to develop and test a site-specific set of alarm resolution procedures. The results of the study are described and include the frequency of alarms, the causes of alarms, the type of resolution, and the modeling of loss estimates.

11091 **Monitoring alarm resolution effectiveness.** Smith, B.W. (Pacific Northwest Laboratory, Richland, WA). *Nuclear Materials Management;* **13**: 330-335(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

An alarm resolution program for nuclear material loss detection using process control data must be able to respond promptly to indications of loss and to distinguish between a systems error and an actual loss of nuclear material. A resolution program consists of procedures to identify causes of alarms, criteria for accepting resolution, and a quality assurance program. A quality assurance program consists of management reviews, audits, quality control activities, routine monitoring of control, and analyses to validate supporting data bases. A program to monitor resolution is necessary to ensure that resolution procedures are consistently applied and that resolution is representative of the causes of an alarm. The key elements in establishing a monitoring program are to develop measures of effectiveness and to properly identify what needs to be controlled.

11092 **Design and evaluation of an integrated safeguards system: principles.** Markin, J.T.; Coulter, C.A.; Gutmacher, R.G.; Whitty, W.J. (Los Alamos National Laboratory, Los Alamos, NM). *Nuclear Materials Management;* **13**: 348-355(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

An integrated safeguards system is defined as a collection of safeguards activities in which system components are coordinated to meet safeguards objectives efficiently within constraints imposed by safeguards resources, facility operations, potential adversaries, and regulatory requirements. This paper describes principles for designing and evaluating an integrated safeguards system that consists of four parts: a problem definition phase that specifies resources and constraints composing the problem boundary values, a system analysis/synthesis phase that describes how to select and integrate safeguards activities for efficient attainment of system objectives, a system evaluation/optimization phase that defines measures of safeguards performance and develops methods for evaluating them, and a decision-making phase that develops principles for selecting admissible designs and preference-ordering designs.

11093 **Supporting the material control and accountancy system with physical protection system features.** Miyoshi, D.S.; Caskey, D.L.; Olson, C.E. (Sandia National Laboratories, Albuquerque, NM). *Nuclear Materials Management;* **13**: 356-360(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Most physical security functions can be accomplished by a range of alternative features. Careful design can provide comparable levels of security regardless of which option is chosen, albeit with possible differences in cost and efficiency. However, the effectiveness and especially the cost and efficiency of the material control and accounting system may be strongly influenced by the selection of a particular design approach to physical security. In this paper, a series of examples are cited to illustrate the effects that particular physical protection design choices may have. The examples have been chosen from several systems engineering projects at facilities within the DOE nuclear community. These examples are generalized, and a series of design principles are proposed for integrating physical security with MC & A by appropriate selection of alternative features.

11094 **Classification of vulnerability information.** Gibson, W.G. (U.S. Dept. of Energy, Washington, DC). *Nuclear Materials Management;* **13**: 366-367(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The current upgrading of security measures at sensitive Department of Energy (DOE) facilities reflects the continuing concern over possible terrorist and other criminal acts against these facilities. Security reviews are periodically conducted at DOE facilities, deficiencies are identified, and corrective actions are recommended. While security upgrades are initiated as soon as possible, the process of securing funding and the construction or other activities necessary to complete upgrades can cause delays in correcting security vulnerabilities. Details of security weaknesses at important DOE facilities are classified in order to deny valuable information to terrorists and other malefactors.

11095 **Protective force legal issues: the security perspective.** Rich, B.L. (U.S. Department of Energy, Washington, DC). *Nuclear Materials Management;* **13**: 373-375(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

There has been much discussion and some controversy on the legal issues faced by the Department of Energy's (DOE) protective forces in the performance of their security duties. These include the observance of legal proprieties in the arrest of non-violent demonstrators, the use of lethal weapons, and the extent of protective forces' authority to carry weapons and protect DOE's security interests offsite. In brief, the need to protect DOE's security interests may be in nominal conflict with other requirements. When faced with a potential conflict in requirements, we in the DOE security community must place first attention to the security mission -- to deter and prevent hostile acts.

11096 **Measurement control assessment of radiometric calorimeters using nonstandards based indicators.** Mayer, R.L. (Monsanto Research Corporation-Mound, Miamisburg, Ohio). *Nuclear Materials Management;* **13**: 32-41(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Radiometric calorimeters are used extensively for plutonium and tritium accountability measurements. Assurance of measurement control for these calorimeters is needed on a daily basis to prevent a large backup of samples which would need to be reevaluated in the event that periodic standard measurements indicated that the instrument was out of control. A study was conducted,

therefore, to determine what method may be used to achieve this purpose. The results of this program indicate that the variance of the bridge potential and sensitivity measurements may be used as indicators that the calorimeter is in control, or that it may be going out of control. These indicators are valid when used along with, not in place of, a standards based measurement control program.

11097 **Characterization of high-fired PuO_2 as a certified reference material.** Legeled, M.A.; Cacic, C.G.; Crawford, D.W.; Spaletto, M.I. (U.S. Department of Energy, New Brunswick Laboratory, Argonne, IL). *Nuclear Materials Management;* **13**: 48-52(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The New Brunswick Laboratory (NBL), U.S. Department of Energy, has certified a plutonium dioxide reference material, CRM 122, for plutonium assay and isotopic composition. The PuO_2 standard, one of several certified Pu reference materials currently being developed at NBL for use in instrumentation calibration and measurement control for safeguards, establishes traceability to the national measurement base. This plutonium reference material in the oxide form provides more directly demonstrable traceability than metal because it undergoes the same chemical treatment for dissolution as PuO_2 fuel materials. Various tests for achieving a constant weight and for dissolving CRM 122 high-fired PuO_2 were conducted. Results of these tests as well as the certification data generated by controlled-potential coulometry for plutonium assay and by thermal ionization mass spectrometry for isotopic composition will also be presented and discussed.

11098 **DOE oversight of facility confirmatory measurement activity.** Proco, G. (U.S. Department of Energy, Oak Ridge, Tennessee). *Nuclear Materials Management;* **13**: 126-129(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

A description of DOE policies and procedures relative to confirmatory measurement as applied to a major field office is presented. In recent years, confirmatory measurements aided by nondestructive assay equipment have increased. Opportunities for more extensive use of this type of measurement exist and should be pursued if more timely identification of significant shipperreceiver differences is to be accomplished. These opportunities cannot be fully met however without advancements in the technology of non-destructive assay equipment and facility commitment to this type of measurement.

11099 **The results of the NLO error propagation exercise.** Gessiness, B.; Lower, C.W.; Porter, G.K. (NLO, Inc., Cincinnati, Ohio). *Nuclear Materials Management;* **13**: 143-148(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The successful conclusion of the Error Propagation Exercise, started 2 years ago at NLO, Inc.'s Feed Materials Production Center, Fernald, Ohio, was reached when a statistically based LEID was determined in a controlled balance area, processing low enriched uranium materials. The three-month test demonstrated that it is possible even in a high-throughput bulk processing facility to collect and process all data necessary for computation of a rigorously determined LEID without interference with production and without significant cost increases. The exercise further demonstrated that much of the data necessary are already collected for other routine uses (e.g., production control, measurement quality control, etc.) so that only a modest increase in data collection is necessary. The automated data collection system developed showed that the additional data can be collected quickly, accurately, and relatively cheaply using readily-available commercial hardware. The benefits of error propagation in terms of increased confidence in nuclear materials safeguards are clear; plans have been developed to extend error propagation to all the enriched uranium processing areas of the Feed Materials Production Center.

11100 **The analysis of tank calibration data from several runs.** Goldman, A.S.; Liebetrau, A.M. (Los Alamos National Laboratory, Los Alamos, NM). *Nuclear Materials Management;* **13**: 149-153(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The experimentally determined relationship between the level of liquid and volume of liquid in a tank can be used to obtain volume estimates that correspond to liquid-level measurements. Several calibration experiments (runs) are made to estimate the calibration equation. The calibration equation is used to estimate the quantity of liquid transferred from a tank between measurement periods. Difficulties can arise when run-to-run differences are large relative to the precisions of liquid-level and volume measurements. This paper addresses the seldom-discussed but important problem of combining and analyzing data from two or more calibration runs. Emphasis is placed on exploratory methods such as diagnostic plots that are compatible with applicable statistical models.

11101 **Automatic material identifier.** Erkkila, B.H. (Los Alamos National Laboratory, Los Alamos, NM). *Nuclear Materials Management;* **13**: 154-157(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Radiation survey instruments could be used to verify the presence of radioactive material inside a container, but identification of the material would not be possible. One could imagine a very complex detector-analyzer system to analyze the radiation being emitted from a container, but it would be very large and difficult to use. At Los Alamos, a portable instrument with some limitations has been developed to identify plutonium and uranium inside a container. The instrument consists of a thin NaI crystal and an electronics package which is based on a microcomputer. The instrument uses the energy spectrum of the emitted radiation to identify the nuclear material present. The function of this instrument is to provide the user a tool for qualitative verification of nuclear materials in a container. The instrument can distinguish plutonium-239 and uranium-235 from other radioactive materials. A count rate indicator provides some measure of the quantity of material.

11102 **An activated barrier for protection of special nuclear materials in vital areas.** Timm, R.E.; Miranda, J.E. (Argonne National Laboratory, Argonne, IL). *Nuclear Materials Management;* 158-161(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The Argonne National Laboratory and Sandia National Laboratory have recently installed an activated barrier, the Access Denial System (ADS) for the upgrade of safeguards of special nuclear materials. The technology of this system was developed in the late 70's by Sandia National Laboratory-Albuquerque. The installation was the first for the Department of Energy. Subsequently, two additional installations have been completed. The Access Denial System, combined with physical restraints, provide the system delay. The principal advantages of the activated barrier are: (1) it provides an order of magnitude improvement in delay over that of a fixed barrier, (2) it can be added to existing vital areas with a minimum of renovations, (3) existing operations are minimally impacted, and (4) health and safety risks are virtually nonexistent. Hardening of the vital areas using the ADS was accomplished in a costeffective manner.

11103 **Motion sensor evaluation using simulation.** Workhoven, R.M.; McNerney, R.M.; Schmutz, J.D. (Sandia National Lab., Albuquerque, NM). *Nuclear Materials Management;* **13**: 162-168(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Thorough evaluation testing of interior motion sensors requires repeated testing under a variety of environmental conditions. Although the sensors are intended primarily for interior installations, many of the buildings where protection may be required are warehouses or bunkers without environmental control. In evaluating sensors for such installations, it becomes important to collect data not only on coverage or sensitivity at room temperature but also at environmental extremes. This paper describes a system Sandia National Laboratories at Albuquerque (SNLA) has designed and built to provide repeatability in environmental testing. The system has been dubbed Sandia Intruder Motion Simulator (SIMS).

This system is used to acquire much of the data now collected on sensors in the laboratory and a duplicate system has been delivered to the Belvoir R & D Center so that the laboratory can now run similar tests.

11104 **Example motion sensor test results using the Sandia Intruder Motion Simulator.** Sons, R.J.; Jones, D.P.; McNerney, G.M. (Sandia National Laboratory, Albuquerque, NM). *Nuclear Materials Management;* **13**: 169-173(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Sandia National Laboratories at Albuquerque (SNLA) has designed and built a system to provide repeatability in environmental testing of motion sensors. This system, called Sandia Intruder Motion Simulator (SIMS), is used to acquire much of the data now collected on sensors in this laboratory. This paper reports the results of environmental evaluations performed on several different types of motion sensors using the SIMS.

11105 **Emphasis: an active management model.** Gray, L.M. (Oak Ridge National Laboratory, Oak Ridge, TN). *Nuclear Materials Management;* **13**: 200-202(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The Institute of Nuclear Materials Management was founded and has grown on the basis of promoting professionalism in the nuclear industry. This paper is concerned with professional management of nuclear material. The paper introduces the reader to Emphasis, an active management model. The management model provides the framework to assist a manager in directing his available resources. Emphasis provides for establishing goals, identifying and selecting objectives, matching objectives to specific personnel, preparing and monitoring action plans, and evaluating results. The model stresses crisis prevention by systematically administering and controlling resources. A critical requirement for implementation of the model is the desire to manage, to be in charge of the situation. The nuclear industry does need managers - people who realize the sensitive nature of the industry, professionals who insist on improved performance.

11106 **Safeguarding NDA systems.** Studley, R.V. (E.I. du Pont de Nemours, Savannah River Plant, Aiken, SC). *Nuclear Materials Management;* **13**: 264-268(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Nondestructive assay measurements are more susceptible to error than is consistent with currently available instrument and physical security techniques. Measurement accuracy and control of sample geometry are being improved. However, little is being provided to protect equipment, measurement geometry, or data in these new systems. Four goals, if achieved, could increase overall performance and measurement confidence: automating measurements and equipment, monitoring of equipment performance, protecting equipment and data, and deploying equipment to assure that measurements are made. Two basic accountability measurements and four nondestructive assay instruments are examined with respect to achieving these goals.

11107 **Demonstration of the calorimetric assay of large mass, high burn-up PuO_2 samples.** Strohm, W.W.; Carchon, R.; Rodenburg, W.W. (Monsanto Research Corporation-Mound, Miamisburg, OH). *Nuclear Materials Management;* **13**: 269-272(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

A joint U.S./Euratom/IAEA evaluation of the calorimetric assay of large mass, high burn-up PuO_2 was conducted at CEN/SCK, Mol, Belgium, under the U.S. DOE/Euratom agreement for cooperation in safeguards R & D. Mound provided a large, twin-bridge calorimeter for this demonstration. PuO_2 material from COGEMA France (Pu-239 ≃ 58 wt %) was prepared by Belgonucleaire. The demonstration was conducted in two phases. The first phase was to evaluate the homogeneity of two batches of PuO_2 which had been blended and characterized at Belgonucleaire in 1980. Watts/gram tests were made on twelve approximately 70g samples from each batch. For the batch selected, the watts/gram test showed an RSD of 0.25%, in good agreement with an RSD of 0.21% in chemical assay values obtained in 1980. Thus, suitable Pu elemental homogeneity with little or no isotopic nonhomogeneity was demonstrated. For the second phase, PuO_2 from the selected batch was packaged into four containers with the PuO_2 content varying from approximately 1 kg to 3 kg; the thermal powers of the four samples varied from 14.5 to 35.8 W. The accuracy of the calorimetric assay of the Pu content of these four containers, compared to chemistry, was 0.3% with measurement times ranging from 4 to 8 hr. These well characterized samples are being used by Euratom and the IAEA for additional NDA evaluation.

11108 **Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel.** Proctor, A.E.; Akers, D.W.; Harker, Y.D.; Mandler, J.W. (EG & G Idaho, Inc., Idaho Falls, Idaho). *Nuclear Materials Management;* **13**: 282-292(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

A delayed-neutron assay method is described which is capable of accurately determining the ^{235}U and ^{238}U contents of a wide range of materials. The method consists of irradiation in the Coupled Fast Reactivity Measurement Facility (CFRMF) at the Idaho National Engineering Laboratory (INEL), one position in the thermal driver area for ^{235}U assay, and a fast neutron flux position for ^{238}U. After irradiation, delayed neutron counting is used to measure the uranium content of the sample. By utilizing fast and thermal neutron irradiation and counting cycles, the samples ^{238}U and ^{235}U contents are determined. Minimal sample preparation and handling is required to obtain accurate results. The method has been used successfully on a wide range of samples, including environmental (soil) samples, irradiated and unirradiated fuel, and debris from the Three Mile Island Unit II Reactor core. Measurement precision of up to 0.5% can be achieved; sensitivity for low level samples is 9 counts min^{-1} $nanogram^{-1}$ for ^{235}U and 0.02 counts min^{-1} $nanogram^{-1}$ for ^{238}U. The fissile and/or fertile contents of samples containing ^{233}U, ^{239}Pu, ^{240}Pu, ^{237}Np, or ^{232}Th could be determined by the same method. Data from representative samples are presented to illustrate the usefulness of these techniques.

11109 **Maintenance and the upgraded security system.** Martin, J.P.; Ledbetter, D.M. (Sandia National Laboratories, Albuquerque, NM). *Nuclear Materials Management;* **13**: 303-305(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

Many facilities have installed or are planning to install upgraded security systems involving state-of-the-art electronic equipment, intrusion detection sensors, closed circuit TV systems, and active delay components with associated command and control systems. While this equipment may provide the required support for the security forces when it is installed, it can and will become a burden and yield degraded security if it is not properly maintained. This condition can exist even though it is not obvious to the operators. A program embodied in the operation of the facility is required to assure that the system continues to perform as it was designed. Recommended approaches to this problem are addressed and benefits to be gained from dedicated security maintenance teams are discussed based on experience gained during operation of the Pantex Plant physical security system and from assisting in the implementation of upgraded systems at many DoD facilities.

11110 **Developing a curriculum for training nuclear protective force persons in legal matters.** Cadwell, J.J. (Brookhaven Nat. Lab., Upton, NY). *Nuclear Materials Management;* **13**: 376-382(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The development of a curriculum for the training of security officers involves the integration of the importance of the subject, the difficulty of the subject and a consideration of the time available for the lecture. The importance of the subject is regarded as a combination of 1) the frequency the officer will need to use the ma-

terial in the field and 2) the possible consequences of the officer not being well trained in the subject. The result of these considerations is a recommended seven-hour curriculum consisting of three hours of instruction on 1) the law of arrest, search and seizure, 2) one hour of instruction on the use of force, 3) two hours of instruction on the scope of legal authority and 4) one hour of instruction on civil liability.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

11111 **(INIS-CL—002) Technical and economical feasibility studies and preliminary plan of a heavy water plant by the cryogenic distillation method of hydrogen.** Dias Vargas, F. (Chile Univ., Santiago). 1983. 232p. (In Spanish). NTIS (US Sales Only), PC A11/MF A01. File Number DE86780345.

This paper presents the pre-feasibility study of a heavy water production plant, both from the technical and economical point of view. Cryogenic distillation of hydrogen is used as the final enrichment stage. The deuterium source is water treated previously by a process of enrichment based on the water-hydrogen isotopic exchange. The economical analysis is aimed at the study of the feasibility of the installation of a heavy water moderated reaction in Chile. General properties of heavy water are presented and also the various materials of its enrichment at the industrial scale. The plant itself has a first stage based on the water-hydrogen isotopic exchange process, where deuterium is extracted from the water by the hydrogen which is subsequently treated in a cryogenic distillation stage. An important fact of the plant analysis is the calculation of heat exchangers mainly in relation to the problem posed by the hydrogen's low point of liquifaction. The distillation units are also treated and designed. The economic evaluation produces project discount rates of 15.71% and 21.97%, for 25 tons/year and 40 tons/year of production capacity. The heavy water price used for these evaluation was 600 $/Kg.

11112 **(K/OA—226) Process design criteria for a plant producing nitrogen-15.** Hanig, M.; Jacobs, S.C.; Johnson, W.N. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jan 1957. Contract AC05-84OT21400. 21p. (CONF-570404—1). NTIS, PC A02. File Number DE86000318.

From Symposium on isotope separation; Amsterdam, Netherlands (22 Apr 1957).

The cost of producing nitrogen-15 by chemical exchange between nitric acid and nitric oxide was re-examined at the request of J.S. Drury. The present study was made on a slightly different set of bases, the important changes being that (1) the loss rate in each product type refluxer was set at 0.00005 times the molar quantity of nitrogen processed by that refluxer and (2) a separation factor of 1.055 was used. The general approach to the problem, while somewhat arbitrary, was to construct a set of cost equations into which parameters of various cascade configurations could be channeled. The parameters considered were (1) number of enricher sections, (2) flow rates in each section, and (3) taper point assay. The feed assay was taken at the natural abundance of 0.0038 mol fraction of nitrogen while the waste assay was fixed at 0.0017 mol fraction of nitrogen. No taper was considered in the stripper section, it having the interstage flow of the widest enricher section. Costs were computed for use of both 21% and 100% SO_2 in the product-type refluxers. A plant consisting of a two-section enricher with intermediate reflux and with a square stripper was selected as representative of a number of attractive plants. The cost of nitrogen enhanced to 95% nitrogen-15 was estimated to be about $1730 per pound ($3.80 per gram) based on an amortization period of 6.25 years. A lower product cost was found to be associated with the use of 21% rather than 100% SO_2 in the product reflux reaction.

11113 **(ORNL/TM—9809) Stable isotope inventory requirements and enrichment capabilities.** Bell, W.A.; Tracy, J.G. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 54p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004659.

The electromagnetic isotope enrichment program established in 1945 has since then continued to provide enriched stable, actinide, and selected radioactive isotopes. These unique materials used in research and medicine and for industrial applications are made available throughout the world by direct sales and/or on a loan basis. In recent years, the primary effort of the program has been directed toward providing enriched stable isotopes necessary to replenish the sales inventory. This document presents a summary of the stable isotope sales requirements and the capabilities of the electromagnetic isotope separators for providing the quantity and quality of enriched products to meet those needs. Special enrichment and actinide separations or Research Materials Collection (loan program) needs are not addressed.

0702 Radiation Sources

11114 **(BNL—37296) Description of the intense, low energy, monoenergetic positron beam at Brookhaven.** Lynn, K.G.; Mills, A.P. Jr.; Roellig, L.O.; Weber, M. (Brookhaven National Lab., Upton, NY (USA); Bell Labs., Murray Hill, NJ (USA); City Coll., New York (USA)). 1985. Contract AC02-76CH00016. 6p. (CONF-8510220—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005057.

From Murr slow positron beam workshop; Columbia, MO, USA (1 Oct 1985).

An intense ($4 \times 10^7\ s^{-1}$), low energy ($\approx$1.0 eV), monoenergetic ($\Delta E \approx 75$ MeV) beam of positrons has been built at the Brookhaven National Laboratory. This flux is more than 10 times greater than any existing beam from radioactive sources. Plans are underway to increase further the flux by more than an order of magnitude. The intense low energy positron beam is made by utilizing the High Flux Beam Reactor at Brookhaven to produce the isotope ^{64}Cu with an activity of 40 curies of positrons. Source moderation techniques are utilized to produce the low energy positron beam from the high energy positrons emitted from ^{64}Cu. 31 refs., 7 figs.

11115 **(CEA-CONF—7420) Preparation of isotopes and sources of actinide elements.** Madic, C.; Bourges, J.; Koehly, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Sep 1984. 24p. (CONF-8409150—6). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750364.

From 12. world conference of the International Nuclear Target Development Society; Antwerp, Belgium (25 Sep 1984).

As the C.E.A. possesses no isotopic separation facility, the productions of isotopes of actinide elements are performed: a) by neutron irradiation and chemical treatment of special targets, b) by milking decay products from stocks of aged actinide elements, c) by chemical treatment of alpha active wastes. These productions concern the following isotopes: ^{233}U, ^{238}Pu, ^{242}Pu, ^{243}Cm, ^{242}Cm, ^{244}Cm (a); ^{228}Th, ^{229}Th, ^{234}U, ^{237}U, ^{239}Np, ^{240}Pu, ^{241}Am, ^{248}Cm (b); ^{237}Np, ^{241}Am (c). These isotopes are produced to satisfy French and international needs and are sent to users in various forms: solutions, metals, oxides, fluorides, or in different sources forms. The preparation of the sources represents an important field of activities divided into two parts: 1/Industrial sources: production of large series of different sources, 2/ Scientific sources: production of sources suitable for a specific scientific problem. A large overview of these activities is given.

11116 (CONF-8411226—Trans., pp 311-324) **Irradiation as a process in competition with deep-freezing.** Gruenewald, T. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

The processing and preservation of foods have reached a high standard of technology. Nevertheless, a lookout for new preservation methods is constantly kept (hygiene requirements, energy savings). One of these new methods is food irradiation. The basic research has already been done, and now the way is open towards industrial application. First, there is a report on the principles of irradiation and the type of rays (gamma rays from the radioactive isotopes 60-Co and 137-Cs), their effects on microorganisms, the conditions of irradiation and radiosensitivity, after which some practical examples are listed. Comment is made on the effects of

low and medium radiation doses on micro-organisms and enzymes, the extension of the period of preservation (combination of cooling and irradiation) and hygienisation (extermination of pathogenic micro-organisms). At high doses from 10 to 50 kGy radiosterilisation can be achieved (radappertization). Remarks on the industrial use of this method concern the radiation sources (gamma radiation equipment with pallets), legal authorisation, health and wholesomeness, legal regulations. At present, the consumer organisations are maintaining a hostile attitude to food irradiation.

11117 (CONF-8411226—Trans., pp 325-339) **Tests on deep-freeze reactions of liquid foods using pulsed NMR spectroscopy.** Harz, H.P.; Weisser, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

In order to get the best out of deep freezing processes, both from the technical and the economic points of view, better knowledge of reactions to deep freeze is necessary, especially on the freezing balance of the food concerned. The solubility curve of the concentration diagram in a presentation of balance in such a case describes the maximum concentration of the substance dissolved in a solution after the thermodynamic balance has been reached. The freezing balance of a few model foods (juice from apples, grapes, oranges, mandarins and lemons) was worked out by the application of a new process. The measuring apparatus used centres on an NMR Spectroscope (0.47 tesla, proton resonance frequency 20 MHz, very short spin-spin-relaxation time for solids as opposed to liquids). The spectrometric results serve as a diagrammatic representation of the proton content in the solid phase as a function of the low temperature (down to -18°C) of the fruit juice being tested (various sugar concentrations).

11118 (DOE/ER/45062—T1) **Major facilities for materials research and related disciplines. Final report.** (National Research Council, Washington, DC (USA). Major Materials Facilities Committee). 1984. Contract FG01-84ER45062. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004955.

The report presents priorities both for new facilities and new capabilities at existing facilities with initial cost of at least $5 million. The new facilities in order of priority are: a 6 GeV Synchrotron Radiation Facility; an Advanced Steady State Neutron Facility; a 1 to 2 GeV Synchrotron Radiation Facility; and a High Intensity Pulsed Neutron Facility. The new capabilities at existing facilities in order of priority are: centers for cold neutron research, incorporating guide halls and instrumentation; insertion devices on existing synchrotron radiation facilities; an experimental hall and instrumentation at the Los Alamos National Laboratory Pulsed Neutron Source; upgrading of the National Magnet Laboratory; and enriched pulsed neutron targets.

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 11132

11119 (BNL—36756) **Performance results from the Hydrogen Technology Evaluation Center at Brookhaven National Laboratory.** Metz, P.D.; Piraino, M. (Brookhaven National Lab., Upton, NY (USA)). Jun 1985. Contract AC02-76CH00016. 18p. (CONF-850799—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86002503.

From 4. IEA task workshop on electrolytic hydrogen production; Julich, F.R. Germany (14 Jul 1985).

This report presents interim performance results for two hardware characterization efforts performed recently at the HTEC facility: a 15-kW photovoltaic-powered solid polymer electrolyte (SPE) electrolyzer system, and an 85 SLPM (3 SCFM) heat-actuated metal-hydride hydrogen compressor evaluated using a closed-loop test system. In steady state baseline testing, the SPE electrolyzer was found to operate at voltage efficiencies ranging from 93% at 230 Amperes/ft^2 to 83% at 1000 Amperes/ft^2. Least-squared fits of photovoltaic-powered operating data show that electrolyzer performance is degraded only slightly during transient operation. This validates a computer simulation model developed previously. The closed-loop compressor test system is described. Compressor performance results are used to determine optimal operating conditions.

11120 (BNL—51940) **Photovoltaic-powered solid polymer electrolyte (SPE) electrolyzer system evaluation. Final report.** Metz, P.D.; Piraino, M. (Brookhaven National Lab., Upton, NY (USA)). Jul 1985. Contract AC02-76CH00016. 57p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86005300.

The final results of the evaluation of a photovoltaic-powered solid polymer electrolyte (SPE) electrolyzer system at the Brookhaven National Laboratory (BNL) Hydrogen Technology Evaluation Center (HTEC) are presented. The HTEC facility and the SPE electrolyzer system are described. Electrolyzer test results are then presented. A technoeconomic analysis of hydrogen production via PV-powered electrolysis and other options is reported. The use of grid versus photovoltaic electricity is evaluated parametrically. PV-electrolyzer system transient computer results are presented. The economic model on which the technoeconomic analysis is based is appended, as well as fitting equations and coefficients of some of the test results. (LEW)

11121 **Hydrogen and sulfur from hydrogen sulfide-4. Quenching the effluent from a solar furnace.** Kappauf, T.; Diver, R.B.; Fletcher, E.A.; Murray, J.P.; Palumbo, R. (Department of Mechanical Engineering, University of Minnesota, Minneapolis, MN). *Energy (Oxford);* **10**: No. 10, 1119-1137(Oct 1985). (In Russian).

Solar thermochemical production of H_2 and sulfur from H_2S were studied, using a 4.2 m solar furnace as a source of process heat. We used two reactor configurations. The independent variables were temperature, feed rate and pressure. Hydrogen production rate, yield, and the quenc fraction (fractional yield) were measured. High yields (of the order 0.5) and quench fractions (of the order 0.7) were obtained over a range of temperatures and feed rates. Yields were a monotonically increasing, almost linear, function of the temperature. The observations are rationalized by a kinetic model that concludes that gas phase reaction rates are too low to account for the observed yields; a good reactor should embody the heating of the feed stream in contact with a surface to facilitate decomposition of H_2S, and the product stream should be quenched in such a way as to minimize surface reactions. The reactors are described. Mullite, Al_2O_3, Fiberfrax and ZrO_2 are suitable materials of construction from a chemical standpoint. Mullite underwent some sintering, deformation and thinning in the hottest parts of the reactor, where it may have been exposed to high temperature excursions and some cracking, apparently due to thermal stress, where it came in contact with a separator.

11122 **Products found in the anodic oxidation of coal.** Later, D.W.; Bockris, J.O'M.; Murphy, O.J. (Battelle, Northwest Laboratories, Richland, WA). *International Journal of Hydrogen Energy;* **10**: No. 7/8, 453-474(1985).

Lignite has been used to depolarize the anodic reaction in aqueous electrolysis. The nature and concentration of the anodic products has been investigated. Iron was removed from coal by washing. Slurries were made of lignite, grass and wastes. Electrolytes were H_2SO_4, H_3PO_4 and NaOH. Temperatures were 80130°C. Sep-pak cartridges were used for separating coal-derived organic liquids from the aqueous electrolyte phase. A liquid-liquid extraction procedure was also used. GC/MS was used to identify products. The Sep-pak cartridges produced hydrocarbons themselves in solution, and these were monitored and taken into account, so that only compounds found to occur as a result of electrolysis are reported. Thes were largely C_8-C_{18} hydrocarbons. Monolayer dissolution from porous lignite accounts for the material present. Peaks are due to organic reactions. A Kolbe-type process as the basis of the hydrocarbons is discussed. The efficacy of contact betwee coal and the electrode is due to abrasion. The observed limiting currents are consistent with the organics present. The results suggest that increase of temperature to 150°C with enhanced stirring should give

ca 750 mA cm^{-2} limiting current density. Heavy oil may then be extractable from the anolyte; if this is attainable, the credits taken would make pure electrolytic hydrogen comparable in cost with natural gas.

11123 **Solar thermochemical hydrogen: the heat source-process interface.** Funk, J.E.; England, C. (University of Kentucky, Lexington, KY). *International Journal of Hydrogen Energy;* 10: No. 6, 359-364(1985).

A discussion of issues and considerations related to the interface between a solar heat source and a thermochemical hydrogen process and some details of a tubular heat exchanger operating as such an interface in a cavity-type receiver are presented. The issues include the temperature and heat input requirements for the endothermic reaction, type of receiver, heat storage, transient operations, and control. A thermal performance analysis of a tubular reactor/heat exchanger operating in a cavity-type solar receiver is applied to SO_3 decomposition. The analysis produces axial distributions of temperature tube wall and process fluid, reaction rate, conversion, velocity, density, pressure and residence time. Process fluid conditions at the inlet, tube characteristics, reaction kinetics and cavity operating temperature are inputs. The cavity temperature affects average heat flux and, therefore, heat-exchanger cost and receiver efficiency and, therefore, mirror field cost. A design which minimizes the combined cost may be found and examples are shown.

0802 Storage

REFER ALSO TO CITATION(S) 11119

0808 Properties

REFER ALSO TO CITATION(S) 11349

09 OTHER SYNTHETIC AND NATURAL FUELS

REFER ALSO TO CITATION(S) 11502

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 10757, 10759, 10916

11124 (CEER-X—163, pp vp) **Opportunities for biomass energy projects in the State of California.** Silvey, J.F. 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The State of California has undertaken a program to encourage the use of agricultural and forestry wastes as an energy resource. Technical and financial support has been offered to project proponents planning to use these wastes in direct combustion, gasification, or methane fermentation facilities. The State will offer funding support to more than 20 projects before the end of its five-year Biomass Conversion Demonstration Program. Problems have arisen as individual projects have developed. Some of these can be summarized as follows: (1) financial - rate of return and capital cost payback period questions have been a concern for several projects. Unexpected increases in costs (e.g., environmental control equipment) can cause the cancellation of an otherwise worthwhile project; (2) technology - direct combustion of biomass is a well-developed state-of-the-art technology. Learning curve problems continue to exist regarding the application of methane fermentation technology to opportunities in the agricultural sector of California. Difficulties are still being encountered in moving the biomass gasification technology from the laboratory testing stage to actual operating commercial facilities; (3) environmental - environmental considerations associated with biomass-to-energy facilities are generally not a concern. One troublesome problem is the relatively high levels of nitrogen oxide emissions that occur with the direct combustion of biomass. In spite of the problems identified above, biomass utilization in the State of California appears to be here to stay.

11125 (CEER-X—163, pp vp) **Pyrolysis of sugar cane bagasse.** Quensanga, A.; Picard, C. (Centre Universitaire Antilles-Guyane, Guadeloupe, French West Indies). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The thermal degradation of sugar cane bagasse, cellulose, and lignin, have been investigated in various atmospheres (nitrogen, dry air, oxygen) using the dynamic thermogravimetric analysis (T.G.A.) technique between room temperature and 700°C. The component compounds of bagasse appear to pyrolyse independently, lignin being the most thermally stable and hemicellulose the least stable. Fast pyrolysis experiments on dry bagasse samples have been performed in the temperature range 600-1000°C. Gaseous mixtures with interesting proportions of hydrocarbons (mainly methane and ethylene) are obtained. A pyrolysis gas of maximum heating value is produced to nearly 850°C. In our experimental study the gasification yields reach nearly 75% at 1000°C. 8 references, 7 figures.

11126 (CEER-X—163, pp vp) **Use of appropriate technologies for biomass waste conversion in small communities.** Vigil, S.A.; Williams, D.W.; Spitzka, R.E.; Theisen, H.M. (Brown and Caldwell Consulting Engineers, Walnut Creek, CA). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

This paper describes several simple, appropriate technologies for biomass waste conversion which can be applied in rural or small community settings. Technologies to be discussed include ethanol production from cannery wastes with a mobile fermentor/still, production of medium-energy fuel gas from animal manures, and production of low-energy fuel gas from agricultural and municipal wastes. Each of the technologies are briefly discussed. 15 references, 3 figures, 7 tables.

11127 (CEER-X—163, pp vp) **Vegetable oils as substitutes for diesel oil.** Salama, C.; Rosa, L.P. (COPPE/UFRJ, Brazil). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Since some physical-chemical characteristics of the vegetable oils are similar to those of the diesel oil, vegetable oils have been appointed as the potential substitute of diesel oil - the combustible responsible for almost 90% of the passengers transportation and 70% of the load transportation in Brazil. Brazil grows a large number of oil plants and is a traditional producer of vegetable oils. However, a program for the expansion of the production of vegetable oils for energetic utilization should include a long time agriculture development. Despite the Brazilian position as an important producer of vegetable oils, the quantities of these involved in the substitution of diesel oil are much bigger than their real availability in the country. Care must be taken in order not to harm the food agriculture. Moreover, the international prices of the vegetable oils are greater than the price of the diesel oil. The utilization of vegetable oils in diesel engines has been tested at many industries and research centers, in two different ways: mixing them with diesel oil and pure, after being processed. These tests must be continued in order to find the best manner of utilizing the vegetable oils as combustible. The economic and social impacts derived from the implantation of a program like the one mentioned above must be carefully analyzed. 11 references.

11128 (CEER-X—163, pp vp) **Energy-integrated farm plan for Puerto Rico.** Alexander, A.G. (Univ. of Puerto Rico, San Juan). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

A design and operations analysis has been prepared for an energy-integrated dairy farm on Puerto Rico's semi-arid south coast. The energy integration system has two functions: (a) to produce green feed, electricity, and high-protein feed substitutes

from manure, and (b), to establish a waste-management system in compliance with local environmental quality regulations. The integrated complex consists of eight subsystems. These include manure preparation and blending, biogas generation, biogas utilization, solids dewatering and drying, wastewater cleaning in algae and fish ponds, wastewater recycling, and green feed production in the form of heavily-manured napier grass. System design and installation costs are estimated at about $600,000. Annual operations costs are placed at $55,000 and annual benefits at about $150,000. A waste management value of $48,000/annum is also credited to the operational system. As an energy- and feed-producing enterprise the system's payback time is about 6.1 years. With waste management values included the payback time is estimated at 4.1 years. Project funding in the order of $830,000 is provided by DOE and the PR Energy Office. Installation time is estimated at 18 to 24 months. 8 references, 5 figures, 8 tables.

11129 **(DOE/ER/10705—10) One carbon metabolism in anaerobic bacteria: organic acid and methane production. Final technical report.** Zeikus, J.G. (Michigan State Univ., East Lansing (USA). Dept. of Biochemistry). 1985. Contract AC02-80ER10705. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004506.

Organic acids (i.e acetate and butyrate) and methane are respectively important as a chemical commodity and a fuel source for industry. Both of these products can be generated via bacterial fermentation of single carbon compounds (i.e, H_2/CO_2, HCOOH, CO CH_3OH) derived from syngas or the pyrolysis of either coals-peats or renewable biomass. This research aims to understand the pathways and regulation of one carbon metabolism in acidogenic and methanogenic bacteria by detailed physiological and biochemical studies. These investigations will characterize and compare formate, methanol, H_2/CO_2, CO, and acetate metabolism of Methanosarcina barkeri with that of Butyribacterium methylotrophicum. The research will focus on: elucidation of the function of formate dehydrogenase and carbon monoxide dehydrogenase; the catabolic routes and biochemical mechanisms for transformation of single carbon compounds and acetate; and, the regulation of single carbon metabolism during growth on multiple C_1 substrates or on multicarbon substrates. 8 refs.

11130 **(DOE/PC/70788—T3) FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report.** Wolf, E.E. (Notre Dame Univ., IN (USA). Dept. of Chemical Engineering). 15 Nov 1985. Contract FG22-84PC70788. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86002829.

During the last quarter several objectives were attained: (1) a strong dependence between the catalytic properties of Pd/ZSM5 during CO hydrogenation and the cation-exchanged form of the support has been established; (2) steady-state kinetic and spectroscopic results were duplicated for the same system under transient conditions; (3) infrared spectra indicates that the structure of adspecies present during CO hydrogenation may be related to production rate and selectivity. 8 figs.

11131 **(DOE/PC/70800—T3) Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985.** Cooper, B.R.; Montano, P.A. (West Virginia Univ., Morgantown (USA). Dept. of Physics). 1985. Contract FG22-84PC70800. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004263.

The preparation and examination by LEED and Auger spectroscopy epitaxial iron films evaporated onto carefully prepared, oriented monocrystals of copper is described. A new method of calculating work functions as accurately as other ab initio methods has been developed and is in excellent agreement with experiment. (LTN)

11132 **(PNL-SA—13471) Low-temperature thermochemical conversion of high-moisture biomass feedstocks.** Butner, R.S.; Sealock, L.J. Jr.; Elliott, D.C. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1985. Contract AC06-76RL01830. 18p. (CONF-8510167—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004863.

From Biomass thermal chemical conversion contractors' meeting; Minneapolis, MN, USA (15 Oct 1985).

Pacific Northwest Laboratory is carrying out a research project to investigate the thermochemical conversion of high-moisture biomass feedstocks to methane, hydrogen, and liquids. Experimental results obtained in FY 1985 indicate that good yields of methane-rich gas (exceeding 40% methane) can be produced. The reaction system utilizes low tempreatures (400 to 450°C), high pressures, and a nickel/alkali carbonate catalyst mixture to effect the gasification of biomass slurries containing up to 95% water. Carbon conversions after 15 minutes have exceeded 90%. Methane yields in excess of 6 scf/dry ash-free pound of biomass have been obtained. Most of the feedstocks selected for investigation are not conventionally used in thermochemical conversion. Feedstocks which have been used to data include napier grass, sorghum stover, sunflower stalks, water hyacinths, and macrocystis kelp. Waste biomass from the food and beverage industries has also been used, as has the unconverted residue from an anaerobic digestor. In addition to gasification performance data obtained for each of these feedstocks, elemental analyses, ash contents, and moisture contents of the raw feedstocks were determined. 5 refs., 8 figs., 2 tabs.

11133 **Biomass fuel use in agriculture under alternative fuel prices.** Bjornstad, D.J.; Hillsman, E.L.; Tepel, R.C. (Oak Ridge National Lab., TN). *Transactions of the ASAE;* 27: No. 6, 1687-1688(Nov 1984).

A linear programming model is used to analyze cost-competitiveness of biomass fuels in agricultural applications for the projected year 1990. With all else held constant, the prices of conventional fuels are increased and analytically compared to prices for biomass fuel products across a variety of end uses. Potential penetration of biomass fuels is measured as the share of each conventional fuel for which cost savings could be realized by substituting biomass fuels. This study examines the cost competitiveness of biomass fuels produced on farms, relative to conventional fuels (diesel, gasoline, natural gas, LPG, fuel oil, and electricity), as the prices of conventional fuels change. The study is targeted at the year 1990 and considers only fuel use in the agricultural sector. The method of analysis is to project fuel demands for ten farm operations in the year 1990 and to match these with biomass fuel substitutes from ten feedstock and nine process alternatives. In all, 61 feedstock/process combinations are possible. The matching of fuel demands and biomass fuels occurs in a linear programming model that seeks to meet fuel demands at minimum cost. Two types of biomass fuel facilities are considered, assuming a decentralized fuel distribution system. The first includes on-farm production units such as oil presses, low-Btu gasifiers, biogas digestors and direct combustion units. The second type of facility would be run by a farm co-operative. The primary data describing the biomass technologies are cost per unit output, where costs are calculated as first-year capital charges, plus al l allocable operating expenses, less any by-products of value. All costs assume commercial purchase of equipment. Homemade or makeshift installations are not considered. 1 reference.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 10755, 11126, 11133

11134 (CEER-X—163, pp vp) **Grain sorghum stillage processing: nutrient recovery and pollution control.** Sweeten, J.M.; Lawhon, J.T.; Schelling, G.T.; Etheredge, R.S. (Texas Agricultural Experiment Station, College Station). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

A farm scale ethyl alcohol plant (114 1/day) at Texas A and M University was used for more than 100 fuel alcohol production experiments involving grain sorghum, corn, sweet potatoes and carrots as feedstocks. Whole stillage from grain sorghum fermentation was separated using a commercial dewatering screw press into two fractions: wet pressed solids and thin stillage liquids. The wet pressed solids were palatable to cattle and had a dry matter digestibility of 77% in feeding trials. The amino acid content and protein quality of stillage fractions were superior to the grain sorghum feedstock. Thin stillage from the screw press was highly polluted wastewater, which contained 60,000 ppm total solids and 92,700

ppm COD, and had a pH of 4.0. Thin stillage liquids from several batches were processed further by centrifugation. It yielded a centrifuge cake containing 43% crude protein. Reverse osmosis (RO) produced 92% reduction in total solids concentration of centrifuge supernatant and 82% reduction in COD. Almost all the starch, sugar and fiber were retained in the RO concentrate which had one-tenth the mass of centrifuge supernatant. RO concentrate may be useful for ethyl alcohol plant feedstock, biogas production through anaerobic digestion, or dehydration for animal feed stuffs. Ultrafiltration (UF) removed more nitrogen for centrifuge supernatant than RO but was not as effective in removing starch, sugars, total solids or chemical oxygen demand. The UF permeate was processed further by RO to produce an overall reduction of 96-100% in concentrations of most water pollutant parameters and nutrients. However, the remaining wastewater still contained high concentrations of total solids and COD and would require additional wastewater treatment or land disposal. 12 references, 3 figures, 9 tables.

11135 (CEER-X—163, pp vp) **Fermentation ethanol can be a partial solution to the energy crisis.** Rizk, G.S. (Jacksonville Electric Authority, FL). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The world demand for energy has been steadily increasing, while conventional new energy sources are lagging behind. Increasing the use of coal and nuclear energy must face rigid environmental regulations. Hence fuel ethanol from biofeedstock can play an important role in supplementing the existing precious liquid fuel. Few nations have excess biofeedstock from which they can produce ethanol economically. Therefore, we can conclude conservatively that ethanol can not replace gasoline and will not by itself solve the energy crisis. However, it can certainly decrease the severity for nations with abundance of biofeedstock. Fuel ethanol derived from biofeedstock can be used directly in properly converted engines, or it can be mixed with gasoline to; (a) extend the supply of liquid fuel, (b) enhance its octane rating, (c) reduce imports. In addition, pure fermentation ethanol can replace the industrial ethanol derived from petrochemical feedstock, and it can be used as a building block to form other petrochemical materials. New technological development in biomass conversion and ethanol distillation can make ethanol production an energy efficient process, especially if coal or non-premium fuel (as oil or gas) is used for the process heat. The recent oil glut is certainly a temporary phenomenon and should not affect the long term planning for energy independence. The government should not be short sighted and must continue to provide incentives for the private sector to develop alternative energy sources.

11136 (CEER-X—163, pp vp) **Alcohols and ideas for savings of petroleum crude at local refineries in the Caribbeans.** Jawetz, P. 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Adding 3% ethanol or methanol to low octane gasoline improves the octane value of the gasoline by about one octane number (average over motor and research octane values). Mixtures including up to 20% alcohol are discussed. If one were to achieve a similar octane improvement of the base gasoline via energy intensive processes in reforming and isomerizing of hydrocarbons, one had to use more crude than in the production of lower octane gasoline - that is, crude in addition to the simple substitution of gasoline with alcohol is being saved. This paper discusses the potential for the production of alcohol in the Caribbean area, reviews the existing local refineries' capacity to use the changing petroleum feedstocks in the region and the changing market for products. Ideas are suggested how the establishment of a new alcohol industry could help the ailing Caribbean refineries and benefit local agriculture and general economic policies in the process. The presentation is enlarged to include concrete examples based on reviews of the feasibility of alcohol production in Costa Rica and the Dominican Republic and the operation of refineries in the Gulf area and the Eastern Coast of the US. 5 references.

11137 (CEER-X—163, pp vp) **Full-scale continuous fermentation for the commercial production of fuel ethanol.** Allen, A.S. (Bohler Brothers of America, Inc., Houston, TX). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Until recently, fermentation alcohol from agricultural feedstocks has been produced in the US, by the classical, centuries old batch technique. Batch fermentation is widely perceived to be the state-of-the art in this country, even though advanced continuous fermentation technology, as practiced in Europe and South America, is fully commercialized and readily available. It is the purpose of this paper to present a brief overview of recent commercial experience with continuous fermentation using Vogelbusch technology, a Netherlands company with 50 years experience in fermentation technology. The benefits that can be achieved from this advanced technology include: lower capital costs, reduced manpower, process flexibility, and contamination control. These and other advantages of continuous fermentation are discussed in detail.

11138 (CEER-X—163, pp vp) **Food crop versus energy-crop production in the Caribbean.** Samuels, G. (Univ. of Puerto Rico, San Juan). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The Caribbean countries have been traditionally exporters of agricultural products, primarily sugar. Powerful social and economic changes have occurred in the tropical regions where sugar cane had long reigned as king. The regions have seen increasing population, industrial development and higher living standards placing increasing pressure on local governments to provide food, clothing and energy. Many of these countries do not have sufficient arable land to produce its food and clothing needs, and the energy is almost totally supplied by imported petroleum. There is a solution, either partial or total, to the Caribbean energy problem by using sugar cane, primarily, and other tropical grasses as energy sources. These renewable energy sources can provide biomass for both combustible solids for electricity and fermentable solids for alcohol fuels. The object of the paper is to present possible choices in achieving a balance between food and energy-crop production within the limited land resources of the Caribbean. 9 references, 4 tables.

11139 (DOE/CE/40659—1) **Conversion of food processing wastes into ethanol using a novel biological reactor/separator. Final report, September 1, 1984-September 30, 1985.** Dale, M.C.; Patterson, J.T.; Okos, M.R.; Ladisch, M.R. (Purdue Univ., Lafayette, IN (USA). Dept. of Agricultural Engineering). Sep 1985. Contract AC02-84CE40659. 110p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86004952.

This project deals with scaling up and operating a novel Immobilized Cell Reactor-Separator (ICRS) developed at Purdue University. This reactor uses gas flow through an immobilized cell reactor to remove a volatile product (ethanol) from the fermentation broth. It was found that the life and performance of a small scale reactor could run continuously - 24 hours/day - for a year with no systematic decay in performance. Some contaminants such as wild yeasts or lactobaccillus were able to successfully colonize the reactor causing a performance decay although most contaminants are inhibited by the selective conditions of high acidity, presence of ethanol, and low oxygen tension. Scale-up parameters investigated. Residence time distributions, mass transfer efficiencies, and liquid hold-up as a function of column diameter and operating conditions. It was found that the Peclet number decreased from 122 for a 1 inch column to 58.5 for a 6 inch ID column and finally to 40.6 for a 13 inch ID column. The 13 inch column data should be representative of larger columns as far as the Peclet number, pressure drop, mass transfer and liquid holdup. Process design studies included work with vapor phase dehydration in which it was determined that molecular sieves seem to be the dessicant of choice. We also investigated rectification of the ethanol in the inert gas leaving the ICRS and found that it is quite feasible and that the change in the shape of the equilibrium curve makes it theoretically possible to

achieve anhydrous ethanol through rectification alone. 15 refs., 38 figs., 12 tabs.

11140 **(DOE/FE/60334—T1) Panama coal to methanol project. Phase I. Feasibility Study. Technical progress report.** (Ebasco Services, Inc., New York (USA)). Nov 1983. Contract AI01-83FE60334. 403p. NTIS MF A01; 2; GPO Dep. File Number DE86004524.

This Technical Progress Report contains the results of the investigations performed for the Panama Coal to Methanol Project: Technical efforts associated with the gasification technology evaluation; evaluation of other related process technologies; results of the venture analyses, including the efforts made for structuring the project; results of the ongoing financial analyses and cost projections, including potential and use applications of methanol in Japan primarily for combustion turbine-combined cycle steam/electric utilization. At this time, and for the next few years, the Panama-based methanol fuel is more expensive than oil. However, when measured in terms of KWH production cost in Japan, the use of methanol fuel in combustion turbine, combined-cycle operations appears to create less expensive electric power than that produced from conventional coal direct fired operations using imported coal. This cost advantage arises from significantly lower capital costs and enhanced performance efficiencies associated with combined cycle power generators as contrasted with conventional coal plants equipped with scrubbers. Environmental and social land-use benefits are also much greater for the methanol fuel plant. The cost of electricity from a methanol-fueled combined cycle plant is also expected to compare favorably in Japan with electrical costs from a future liquefied natural gas fired plant.

11141 **(DOE/PC/70780—T3) Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985.** Bischoff, K.B.; Manogue, W.; Mills, G.A. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering). 21 Dec 1985. Contract FG22-84PC70780. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004479.

The identification and analysis of all the individual reaction products formed in the CO hydrogenation over rhodium catalysts has been achieved. This has not been reported by previous workers. The reaction products contain significant amounts of all five classes of oxygenates (namely alcohols, aldehydes, acids, esters and ethers), C1 to C5 hydrocarbons, in addition to carbon dioxide and water formed by the shift reaction. In a series of tests using a Na-Rh/alumina catalyst, varying space rate was used to vary CO conversion from 1 to 13%. Selectivity to oxygenates decreased with increasing conversion. Over this range the C2 oxygenates were found to be a remarkable ca 80% of all oxygenates. From a plot of production of C2 oxygenates as a function of CO conversion, the build-up of secondary reaction products can be observed, which indicates, for example, the sequential formation of acetaldehyde, hydrogenation to ethanol and, with acetic acid, conversion to ethyl acetate. Six new catalysts were prepared to test out various ideas: (1) Ce addition to Rh/alumina increased selectivity to oxygenates slightly; (2) Sn addition to Rh/alumina caused essentially complete deactivation; (3) Rh deposited on alumina as the unusual rhodium acetate dimer was not active at low temperature as hoped. Also at higher temperatures where the complex decomposed, the selectivity to oxygenates was poor; (4) Na added to prereduced Rh/alumina performed identically to a catalyst in which Na and Rh were codeposited on alumina; and (5) Rh deposited on alumina from Rh trichloride solution gave the same results as catalyst prepared using Rh trinitrate solution. Progress was made in catalyst characterization using chemisorption, infrared measurements and temperature programmed desorption. 5 figs., 3 tabs.

11142 **(DOE/PC/71257—T4) Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985.** Holder, G.; Shah, Y.T.; Tierney, J.W. (Pittsburgh Univ., PA (USA)). 1985. Contract FG22-84PC71257. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86003878.

Research is being carried out under two tasks: (1) thermal behavior of slurry reactors used for indirect coal liquefaction; and (2) coal liquefaction under supercritical conditions. For task one work continued in three areas; Fischer-Tropsch synthesis; methanol synthesis via a formate; and methanol synthesis using a Cu-ZnO catalyst. Most attention was given to the synthesis of methanol using a formate intermediate. The reaction involves carbonylation of an alcohol to formate and then hydrogenation to produce methanol. This sequence has an advantage over conventional synthesis methods in that the reaction can be carried out at a lower temperature where higher conversions per pass can be obtained because of more favorable thermodynamics. By using a slurry reactor, both reactions can take place in the same vessel. The carbonylation step uses a homogeneous catalyst and the hydrogenation step uses a heterogeneous catalyst. For task two, the objective was to measure mass transfer rates for naphthalene extraction by carbon dioxide to enable the investigators to determine how mass transfer coefficients vary with pressure flow rate, and bed height. These parameters will influence the design of extraction or reaction processes which utilize supercritical fluids. The data obtained thus far cover mostly the study of the effect of flow rate on solubility of naphthalene at different pressures and temperatures.

11143 **(PB—85-243749/XAB) Production of alcohol from Jerusalem artichoke for gasoline additive.** Pekic, B.; Kisgeci, J. (Novi Sad Univ. (Yugoslavia). Inst. of Microbiological Processes and Applied Chemistry). 1984. 97p. NTIS, PC A05/MF A01.

Trials conducted in 1980 and 1981 on three soil types, chernozem (a rich soil), anthropogenized black sand (a medium-rich soil), and anthropogenized brown sand (a poor soil), showed that the Jerusalem artichoke was superior to conventional field crops (corn, sugarbeet, potato, and sorghum) regarding the yield of carbohydrates per unit area, especially when grown on the poor soil. The analyses of the technological properties of Jerusalem artichokes grown for two years in the experimental plots showed that the plant species is a quality raw material for the production of alcohol. From the aspect of alcohol production, the quality of the tested varieties of Jerusalem artichoke depended neither on soil quality nor on the delay in harvesting the crop after it reached technological maturity. The results of the study indicate that the alcohol production from Jerusalem artichokes would be more economic, i.e., more profitable, than the production from conventional raw materials. The study of the carbohydrate composition of Jerusalem artichoke tubers made it clear that besides alcohol production, Jerusalem artichokes are a good raw material for the production of high-fructose syrup and crystalline fructose. Since the interest in these products kept increasing in recent years, because of their exceptional characters, it is necessary to establish research programs to cover these field too. In the course of the study the authors came across some interesting literature data on the use of Jerusalem artichokes as a raw material for the production of high-fructose syrup and crystalline fructose. Some of the publication, i.e., those that might be useful in further research work, are appended to this study.

11144 **(PNL-SA—13062) Identifying barriers to the commercialization of low-Btu gasifiers.** Easterling, J.C.; Brenchley, D.L.; Russell, J.A. (Pacific Northwest Labs., Richland, WA (USA)). Mar 1985. Contract AC06-76RL01830. 5p. (CONF-841194—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004869.

From Southeast industrial biomass energy exposition; Atlanta, GA, USA (28 Nov 1984).

In November, 1984, a two-day workshop was conducted to gain insight from industry representatives and private and government researchers on the issues that impede commercial use of low-Btu gasifiers. Through a series of group discussions and rank ordering activities, the workshop participants identified the most significant problems with these gasifiers and recommended R & D activities to solve them.

11145 **Recombinant genetic approaches for efficient ethanol production.** Stoke, H.W.; Eveleigh, D.E.; Picataggio, S.K. (Cooke College, Rutgers Univ., New Brunswick, NJ). pp 113-132 of Advances in solar energy: an annual review of research and development, vol. 1. Boer, K.W.; Duffie, J.A. New York, NY; American Solar Energy Society Inc. (1983).

Ethanol has potential use as an alternative liquid transportation fuel and as a chemical feedstock The recent restrictions on the availability of oil focused attention on ethanol production through the microbial fermentation of biomass. The economic incentives to develop such fermentation processes are borderline. This paper discusses the manner in which recombinant genetic approaches may potentially relieve certain of the economic bottlenecks and put the fermentative production of ethanol on a firmer basis. It then reviews the genetics of bacteria and yeasts. The manner in which these processes may be used is illustrated with protocols for the development of new microbial strains that can utilize a range of less expensive substrates (cellulose and starch) and that are more tolerant of high ethanol concentrations.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 11124, 11133, 11138, 11144, 11163

11146 (CEER-X—163, pp vp) **Planning waste-to-energy plants in Puerto Rico.** Betancourt, S.R.; Bracken, B.D.; Huertas, E.J. (Environmental Quality Board, Puerto Rico). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Puerto Rico has adopted a solid waste management and resource recovery plan that encourages industry and jobs by building and operating waste-to-energy plants. The island-wide resource recovery plan is intended to serve as a tool to guide solid waste facility implementation by the Government of Puerto Rico. The first resource recovery project is fully described through the preliminary engineering phase. Descriptions include technology, management, and financing. Specific site considerations include transportation routing, air quality, land use, and aesthetics. Guidance for implementation of seven other projects is given. The complete plan results in a new industry opportunity. Waste regions are set and preferred locations and technologies are shown. 4 figures, 2 tables.

11147 (CEER-X—163, pp vp) **Energy from wastes, current technology.** Engdahl, R.B. 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Worldwide over 300 plants are daily recovering energy from wastes by producing electricity, steam, hot water, or low-energy fuel gas. Mass combustion of raw wastes to release heat energy is the best developed method now available. The technology and economics involved in the combustion of wastes, refuse-fueled boilers, production of refuse derived fuel, methane from landfills, and pyrolysis of municipal wastes are discussed. 4 figures, 1 table.

11148 (CEER-X—163, pp vp) **Displacement of industrial oil consumption in developing countries by wood fuel technologies.** Sabadell, A.J.; Mendis, M.S. (MITRE Corp., McLean, VA). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

An engineering and economic study of new and retrofit industrial combustion equipment for wood fuel use is considered. Four industrial wood-fueled system alternatives are presented: direct wood combustion; wood staged gasification/combustion; wood low-calorific (Btu) value gasification; and wood pyrolysis. The economics of a representative industrial case study in a developing country is shown. The economic assessment is based on the comparison of the alternate wood technologies to an equivalent petroleum-based combustion technology. 5 references, 12 figures, 4 tables.

11149 (CEER-X—163, pp vp) **Industrial wood energy feasibility studies.** Curtis, G.B. Jr.; Didocha, R.J.; McGowan, T.F. (Georgia Institute of Technology, Atlanta). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The Industrial Wood Energy Feasibility Studies were one of five tasks performed under a US Department of Energy grant to the State of Georgia. The project goal was to stimulate the use of wood energy in the industrial sector as a substitute for fossil fuels. The nonforest products sector was chosen due to its lack of experience in procuring and using wood fuels. The project took place from 1979 through 1981. It had five major tasks: industrial wood energy feasibility studies; wood fired boiler demonstration projects; wood fuels processing studies and research; wood gasification research; and technology transfer. The project succeeded in educating Georgia's industry in the use of this renewable alternate fuel. Thirty-six feasibility studies were completed, two wood fired boilers were installed, wood gasification applications tests were run, wood fuel testing standards were promulgated, two major reports were issued on wood fuels processing and wood energy system design, a multitude of publications distributed, and seminars given to disseminate the technology. This paper is a review of the first task on industrial wood energy feasibility studies. Comprehensive reports on this, and the four other tasks are available from Georgia Tech's Engineering Experiment Station Technology Applications Laboratory.

11150 (PB—85-235380/XAB) **Firewood versus alternatives: domestic fuel in Mexico. Occasional paper.** Evans, M.I. (Oxford Univ. (UK). Commonwealth Forestry Inst.). 1984. 79p. (CFI/OP—23). NTIS, PC A05/MF A01.

A detailed survey of two contrasting villages in Mexico made in 1982 revealed a shortage not only of domestic firewood but also of liquid petroleum gas (LPG), the main alternative fuel. Quantitative evidence is given concerning the daily hardship this causes, particularly to women and children. Shortages were principally due to inadequate provisions for social forestry requirements and inadequate distribution systems of LPG in rural areas on the other. The village survey was subsequently placed in the context of the domestic fuel situation in central and southern Mexico.

0905 Liquid Waste Fuels

REFER ALSO TO CITATION(S) 10831

13 HYDRO ENERGY

11151 (DOE/R9/50021—T1) **"Rancho Hydro": a low-head, high volume residential hydroelectric power system, Anahola, Kauai, Hawaii.** Harder, J.D. (Harder (John D.), Kapaa, HI (USA)). Jul 1982. Contract FG03-80R950021. 19p. (HI—80-34). NTIS, PC A02/MF A01; GPO Dep. File Number DE86000350.

The site is a 1.75 acre residential site with two households. The Anahola stream intersects the property line. Design of the proposed hydroelectric system is described, along with the permit process. Construction is in progress. (DLC)

1303 Plant Design And Operation

11152 (DOE/ID/12129—1) **Garland Canal Shoshone Irrigation District hydroelectric project: final operations and maintenance report. Small-Scale Hydroelectric Power Demonstration Project.** (Shoshone Irrigation District, Powell, WY (USA)). Oct 1985. Contract FC07-80ID12129. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005065.

This report describes the major steps undertaken by the Shoshone Irrigation District to develop a new lowhead hydroelectric generation plant and to demonstrate the economic feasibility of such a plant. This report, written as a requirement of the Cooperative Agreement between the Shoshone Irrigation District and the United States Department of Energy, summarizes the operation and maintenance activities, costs, and revenues for the first two years of operation.

11153 **(DOE/RA/12117—5) New York State Electric and Gas Corporation Upper Mechanicville hydroelectric redevelopment project: final operation and maintenance report. Small-Scale Hydroelectric Power Demonstration Project.** (New York State Electric and Gas Corp., Binghamton (USA)). Nov 1985. Contract FC07-80ID12117. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005290.

The Upper Mechanicville Project, the first hydroelectric plant to be developed in recent years by NYSEG, is located at Dam and Lock No. C-3 on the West Bank of the Hudson River about 20 miles upstream from Albany and is part of the Champlain Barge Canal navigation system. As of August 1985, both units have completed two full years of operation. Initially both units required warranty work. Since completion of warranty work, both units have operated exceptionally well and virtually troublefree.

1306 Environmental Aspects

11154 **(PB—85-237139/XAB) Chlorophyll a concentration and distribution in Twin Lakes, Colorado prior to operation of Mt. Elbert Pumped-Storage Powerplant, 1977-1981. Technical report.** Campbell, S.G.; LaBounty, J.F. (Bureau of Reclamation, Denver, CO (USA). Engineering and Research Center). Jan 1985. 47p. (REC-ERC—85-6). NTIS, PC A03/MF A01.

A series of studies is being performed to identify changes in the limnology of Twin Lakes, Colorado, resulting from the operation of the Mt. Elbert Pumped-Storage Powerplant. This report presents preoperation chlorophyll concentrations in Twin Lakes from 1977 through 1981. Twin Lakes are a pair of oligotrophic, dimictic, and cool, high-mountain lakes. The lakes are thermally stratified between spring and fall turnover periods. They are ice-covered in winter and are poor in phosphorus and nitrogen nutrients. Some type of standing-crop, or primary-production estimate is necessary in any ecological evaluation because it represents the size of the food-chain base. The assessment of chlorophyll a concentration is the quickest and easiest way to estimate standing crop in a body of water.

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 11450

1401 Resources And Availability

REFER ALSO TO CITATION(S) 11206

1403 Economics

11155 **(SAND—85-8178) Cost Data Management System. CDMS Version 2.2. Final report.** Weingart, J.M. (Polydyne, Inc. and Associates, San Mateo, CA (USA)). Dec 1985. Contract AC04-76DR00789. 118p. NTIS, PC A06/MF A01. File Number DE86005064.

The Cost Data Management System (CDMS) is a cost data base computer program developed by Polydyne, Inc. and Associates for Sandia National Laboratories Livermore (SNLL). This program constitutes a unique and powerful tool for interactive development and documentation of complex cost data bases for power plants and other construction projects. This program is operational on the Digital Equipment Corporation's VAX computers operating under the latest version (4.1) of the VMS operating system. The original version of the CDMS (Version 1.1) has been extensively used by SNLL in the development, documentation, and analysis of the cost data base for Solar One. As a result of this work, a number of desirable enhancements to the CDMS were identified, and as a follow-on effort, Polydyne, Inc. has revised the original software. This report summarizes the extensive revisions and enhancements made to the CDMS, and discusses the features of the new program (CDMS Version 2.2).

11156 **(SAND—85-8179) Cost Data Management System User's Guide supplement. CDMS Version 2.2.** Weingart, J.M. (Polydyne, Inc. and Associates, San Mateo, CA (USA)). Dec 1985. Contract AC04-76DR00789. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005062.

The Cost Data Management System (CDMS) is a cost data base computer program developed by Polydyne, Inc. and Associates for Sandia National Laboratories Livermore (SNLL). This program constitutes a unique and powerful tool for interactive development and documentation of complex cost data bases for power plants and other construction projects. This program is operational on the Digital Equipment Corporation's VAX computers operating under the latest version (4.1) of the VMS operating system. The original version of the CDMS (Version 1.1) has been extensively used by SNLL in the development, documentation, and analysis of the cost data base for Solar One. As a result of this work, a number of desirable enhancements to the CDMS were identified, and as a follow-on effort, Polydyne, Inc. has revised the original software, resulting in CDMS Version 2.2. This report summarizes the extensive revisions and enhancements made to the original version of the code, and constitutes a supplement to the original User's Guide (SAND83-8175).

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 10831, 11122, 11124, 11125, 11126, 11127, 11128, 11132, 11133, 11134, 11135, 11136, 11137, 11138, 11139, 11143, 11145, 11146, 11147, 11148, 11149, 11182, 11211, 11589, 11704, 11848

11157 **(CEA-CONF—7160) Recent picosecond spectroscopy studies of photoactivated electron transfer reactions in solution.** Mialocq, J.C.; Doizi, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1983. 5p. (CONF-831265—8). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750440.

From 6. international conference on lasers and applications; San Francisco, CA, USA (12 Dec 1983).

Picosecond actinic pulses have been used together with fluorescence and absorption spectroscopy methods to elucidate the elementary processes occurring in natural and artificial solar energy conversion systems: - primary events in Rhodopseudomonas sphaeroides R26 reaction centers, - photoinduced intermolecular electron transfer reactions from the first singlet excited state, - intramolecular electron transfer reactions in a carotenoporphyrinquinone triad molecule. The results are discussed with reference to the energetics of the electron transfer reactions and the role of the spin selection rule.

11158 (CEER-X—163, pp vp) **Economic analysis method for short-rotation forestry.** Vyas, A.D.; Shen, S.Y. (Argonne National Lab., IL). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—). Contract W-31-109-ENG-38.

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

A method for economic analysis of short-rotation forestry is presented in this paper; a model that employs linear complementarity optimization is an important component of this method. Given data on biomass production costs and methods for short-rotation forestry, the model selects the rotation period (i.e., harvesting cycle) that maximizes the net present value of all future profits for a specified discount rate. The ability to select the optimal rotation period is a unique feature of the model. The model's output, combined with independent analysis of the effect of tree spacing on production costs and woody biomass yield, allows specification of least-cost production systems for short-rotation forestry. The results of analyses of three hypothetical forestry plantations in the US are summarized here. These results, while obtained for specific species and growing conditions, support three general conclusions regarding short-rotation forestry. For conventional straight-row planting of trees at a 4 x 4 ft (1.2 x 1.2 m) spacing, forage harvesting is more economical than whole-tree harvesting. Production costs for this planting strategy can be further reduced through an alternative harvesting technique that uses an innovative circular saw harvester now under development. Short-rotation forestry costs can be mini-

mized, however, by adopting a planting approach in which seedling cuttings are sown as grass seeds are sown - randomly and very densely - and year-old saplings are forage harvested. 7 references, 2 figures, 10 tables.

11159 (CEER-X—163, pp vp) **Bamboo as a renewable energy source.** Molini, A.E.; Irizarry, J.G. (Univ. of Puerto Rico, Mayaguez). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Our complete dependence upon imported fossil fuels, forces us to make a conscientious evaluation of the other energy sources we have readily available. Some of the approximately 1000 species of bamboo of some 50 genera, that range from plants the size of field grass to giants 120 feet high and one foot in diameter and grow from the sea level of tropics to 10,000 feet mountain slopes appear to be excellent alternate renewable energy sources. Their peculiarity of blooming at intervals of 30 to 120 years, depending on the species, provide a foolproof way for preserving the genetic characteristics of the species selected for their potential as solid fuel. Observation of existing clumps in Puerto Rico leads to estimates of production rates of more than 1500 green tons per acre every 3-5 years. Air drying tests in the field of 4-5 year old stems show them to average approximately 80% weight of the green stems for production rates of more than 1300 dry tons per acre every 3-5 years which result in yearly averaged production rates higher than 250 tons of dry fiber per acre, equivalent to approximately 300 MWe. This paper presents the results obtained from a recently initiated search effort on the subject. 15 references.

11160 (CEER-X—163, pp vp) **Energy cane alternative.** Alexander, A.G. (Univ. of Puerto Rico, San Juan). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Rising labor costs, declining productivity, lack of effective mechanization, and declining sugar values, among other factors, have eliminated sugar planting as a economic enterprise for Puerto Rico. However, the cane plant retains a highly attractive potential as a domestic energy crop. Through revised management, sugar cane yields in the order of 83 short tons/acre year were attained for whole green cane. Sugar cane managed in this way for high tonnage, as opposed to high sucrose, is now depicted as energy cane. Second-generation energy cane, consisting of revised seedbed management plus varieties specifically selected for biomass, produced over 110 short tons/acre year. Production costs were slightly over $1000/acre year but less than $10.00/green ton. Recoverable energy yields were in the order of 450,000,000 Btu/acre year at costs under $2.00/million Btus. Combined values for fuel and molasses exceed $3000/acre year. The cane plant offers Puerto Rico a relatively cheap boiler fuel. In addition to the fuel component there are several decisive side benefits. Foremost among these is syrup (high-test molasses) needed for the local rum industry. Energy cane bagasse and trash provide lignocellulosic feedstock for a range of liquid fuels, gaseous fuels, and chemicals. Agricultural employment would be increased. Sugar cane's totally destitute future as a sugar crop would be averted. No other alternative energy option offers Puerto Rico so many benefits, as a Puerto Rican-controlled resource, that is climatically, botanically, socially, and historically so adapted to Puerto Rico's needs. 28 references, 3 tables.

11161 (CEER-X—163, pp vp) **Recurrence relation for the calculation of sections of compound conical concentrators.** Hassib, A.M. (King Saud Univ., Riyadh, Saudi Arabia). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Mathematical recurrence relations for the calculation of sections of Compound Conical Concentrators (CCC) are given. Use of these equations for the design of CCC of the trough and dish type is discussed. Equations for receivers of various geometry are presented. Use of the CCC for the production of uniformly distributed concentrated solar flux for application to photovoltaic arrays is illustrated. Simplicity of design and ease of fabrication of these concentrators from common materials is emphasized. 2 references, 4 figures.

11162 (CONF-851050—Absts.) **Coupling of carbon, water, and nutrient interactions in woody plant soil systems. Program and presentation summaries.** (Oak Ridge National Lab., TN (USA)). Oct 1985. Contract AC05-84OR21400. 117p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86000320.

From International symposium on whole-plant physiology: coupling of carbon, water, and nutrient interactions in woody plant soil systems; Knoxville, TN, USA (6 Oct 1985).

This report consists of 63 abstracts of presentations made at the International Symposium of Whole-Plant Physiology - coupling of carbon, water, and nutrient interactions in woody plant soil systems held in Knoxville, Tennessee on October 6-11, 1985.

11163 (ORNL/TM—9832) **Short Rotation Woody Crops Program. Quarterly progress report, June 1-August 31, 1985.** Wright, L.L.; Perlack, R.D.; Layton, P.A.; Wenzel, C.R.; Trimble, J.L.; Ranney, J.W. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 118p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86005263.

This report briefly summarizes activities of the Short Rotation Woody Crops Program (SRWCP) field-management office at ORNL, research accomplishments of the program, and technology-transfer activities in the program. The section entitled "Quarterly Highlight" discusses in depth one research or analysis activity conducted by the SRWCP. The Appendix presents reports on research progress at all institutions under subcontract to the SRWCP. 6 figs., 5 tabs.

11164 (SERI/STR—211-2804) **Stable, high-efficiency, $CuInSe_2$ - based polycrystalline thin-film tandem solar cells. Annual subcontract report, 16 March 1984-15 March 1985.** Birkmire, R.W.; Phillips, J.E. (Delaware Univ., Newark (USA). Inst. of Energy Conversion). Nov 1985. Contract AC02-83CH10093. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016893.

The goal of this program is a high-efficiency, thin-film tandem solar cell based on $CuInSe_2$. The performance of the (CdZn)S/$CuInSe_2$ component in the tandem has been brought up to an efficiency of well over 10%. Significant improvement in a CdS/CdTe thin-film cell compatible with the tandem design has also been achieved. A number of tandem devices have been made and progress continues on increasing the efficiency of the cells presently being produced.

11165 (SERI/STR—211-2813) **Research on high-efficiency, single-junction, monolithic, thin-film a-Si solar cells. Annual subcontract progress report, 1 February 1984-31 January 1985.** Carlson, D.E.; Catalano, A.; D'Aiello, R.V.; Dickson, C.R.; Oswald, R.S. (Solarex Corp., Newtown, PA (USA)). Nov 1985. Contract AC02-83CH10093. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016880.

This research program consisted of five tasks. Task 1, Amorphous Silicon Materials Research, involved producing and optimizing amorphous silicon material. Task 2, Non-Semiconductor Materials Research, involved producing nonsemiconductor materials required to make high-performance, amorphous silicon solar cells. Task 3, Solar Cell Research, involved fabricating and characterizing high-efficiency, single-junction, p-i-n amorphous silicon solar cells. In Task 4, Monolithic, Intra-Connected Cells/Submodule Research, research and development was performed to produce submodules of monolithic, intraconnected solar cells. In Task 5, Multi-Chamber Deposition System, a multi-chamber system was designed to fabricate submodules of at least 1000 cm^2. The major goals of the program are: (1) to obtain a conversion efficiency of at least 12% (AM1) in a single-junction, p-i-n, 1-cm^2 solar cell; (2) to eliminate the deleterious effects of light-induced, metastable centers; (3) to operate a multi-chamber deposition a-Si growth system; and (4) to demonstrate a stable submodule with an 8% conversion efficiency (AM1) and a total area of at least 1000 cm^2.

11166 **(SERI/STR—211-2814) Research on high-efficiency, single-junction, monolithic thin-film amorphous silicon solar cells. Semiannual subcontract progress report, 1 October 1984-31 March 1985.** Delahoy, A.E.; Ellis, F.B. Jr.; Eser, E.; Volltrauer, H.; Weakliem, H.A. (Chronar Corp., Princeton, NJ (USA)). Nov 1985. Contract AC02-83CH10093. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85016886.

One of several tasks of the research reported here is the study of light-induced defects in intrinsic amorphous silicon, including both photoconductivity decay and recovery kinetics. The recovery was found to be thermally activated. The interdiffusion of Al and Si across the Al/a-Si:H interface has also been studied. As far as bulk diffusion of Al and Si is concerned, the interface appears stable at solar cell operating temperatures. However, substantial out-diffusion of Si through Al grain boundaries has been detected. Computer programs have been written for optical analysis of multilayered, thin-film cells with and without light trapping. The energy dependence of the refractive index for undoped a-Si:H and p-type a-Si/sub x/C/sub 1-x/:H has been determined from reflectance and transmittance measurements. The effect of tin oxide morphology on cell performance has also been investigated. Granular tin oxide leads to lower open-circuit voltages but higher currents, fill factors, and efficiencies. Light soaking and annealing studies have been performed on single-junction cells, and the results suggest a reduction in carrier collection length due to excess carrier recombination. The influence of tin oxide resistivity and transmission on module design has also been investigated, and the effect of tin oxide thickness calculated.

11167 **(SERI/STR—211-2818) Photoluminescence of $CuInSe_2$ photovoltaic cells. Final subcontract report, 1 April 1984-31 March 1985.** Sites, J.R.; Hollingsworth, R.E. (Colorado State Univ., Fort Collins (USA). Dept. of Physics). Nov 1985. Contract AC02-83CH10093. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016888.

The variation of the photoluminescence and electronic characteristics of $CuInSe_2$/CdS solar cells have been examined as a function of annealing temperature with an air environment. Cell efficiency improves for annealing temperatures up to 500 K but is rapidly degraded at higher temperatures. Photoluminescence shows that the efficiency gain is correlated to a decrease in the density of native defects in the $CuInSe_2$. There is a corresponding increase in the net carrier concentration of the selenide due to a reduced compensation ratio. Comparison of photoluminescence from the free surface of $CuInSe_2$ with that from the material covered by CdS shows a lower defect density at the free surface after annealing. Degradation at higher annealing temperatures comes primarily from cadmium diffusion into the $CuInSe_2$, with an increase in the native defect density in the selenide contributing to a lesser extent. Large shifts between the light and dark current voltage curves appear to be due to cadmium impurities in the $CuInSe_2$ and the corresponding cadmium vacancies in the CdS.

11168 **(SERI/STR—211-2831) Laser-heated CVD process for depositing thin films for low-cost solar cell applications. Annual subcontract progress report, 1 February 1984-31 May 1985.** Haggerty, J.S.; Adler, D. (Massachusetts Inst. of Tech., Lexington (USA)). Nov 1985. Contract AC02-83CH10093. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016887.

Significant progress has been made toward using laser-induced chemical vapor deposition (LICVD) of a-Si:H films in photovoltaic (PV) applications. This report describes research in which the investigators accomplished the safety and equipment changes needed for the deposition of doped films; achieved both n- and p-doping by LICVD for the first time; adapted the existing electrical conductivity measurement apparatus to the requirements of doped films; continued investigating the deposition process; characterized the properties of doped and undoped films with an emphasis on properties crucial to the success of the PV project; and fabricated the first solar cells using LICVD material as the intrinsic layer.

11169 **(SERI/STR—211-2845) Research on high-efficiency, stacked, multijunction, amorphous silicon alloy thin-film solar cells. A semiannual subcontract progress report, 1 October 1984-15 May 1985.** Dalal, V. (Spire Corp., Bedford, MA (USA)). Nov 1985. Contract AC02-83CH10093. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016875.

This technical progress report to the Solar Energy Research Institute covers work on high-efficiency, stacked, multijunction amorphous silicone alloy thin-film solar cells. Material growth was begun in a multisector reactor. The a-Si:H films grown in this reactor were very high quality, as shown in their high ratio of photo-to-dark conductivity and very low dark conductivity. High-bandgap a-Si:H films were achieved by using H etching of films during growth. H_2 dilution in the plasma led to a sharpening of the valence band tail in both a-Si:H and a-(Si,Ge):H films. No SiH_2 bonds were observed after Ge was added to the a-Si:H. Experiments were begun to develop a two-level, stable back contact to a-Si:H. Preliminary results indicate that a Cr/Pd contact may be stable and moderately reflecting, but the best reflection was obtained with Ag. Mo appears to be a suitable, stable contact to SnO_2. A critical parameter in achieving 8.5% efficient a-Si:H devices was plasma-cleaning between deposition of the p- and i-layers. 6.5% efficient a-(Si,Ge):H devices were also grown. Two types of tandem cells were fabricated.

11170 **(SERI/STR—231-2799) Studies of marine macroalgae: saline desert water cultivation and effects of environmental stress on proximate composition. Final subcontract report.** Ryther, J.H.; DeBusk, T.A.; Peterson, J.E. (Harbor Branch Foundation, Fort Pierce, FL (USA)). Nov 1985. Contract AC02-83CH10093. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016889.

The results presented in this report address the growth potential of marine macroalgae cultivated in desert saline waters, and the effects of certain environmental stresses (e.g., nitrogen, salinity, and temperature) on the proximate composition of several marine macroalgae. Two major desert saline water types were assayed for their ability to support the growth of Gracilaria, Ulva, and Caulerpa. Both water types supported short term growth, but long term growth was not supported. Carbohydrate levels in Gracilaria were increased by cultivation under conditions of high salinity, low temperature, and low nitrogen and phosphorous availability. Data suggests that it may be possible to maximize production of useful proximate constituents by cultivating the algae under optimum conditions for growth, and then holding the resulting biomass under the environmental conditions which favor tissue accumulation of the desired storage products. 16 refs., 21 figs., 19 tabs.

11171 **Indium tin oxide/gallium arsenide solar cells.** Naseem, S.; Coutts, T.J. (School of Physics, Newcastle upon Tyne Polytechnic, Newcastle upon Tyne, England NE1 8ST). *Journal of Applied Physics;* **58**: No. 11, 4463-4464(1 Dec 1985).

This communication discusses the performance of solar cells based on single-crystal substrates of p-type gallium arsenide (GaAs) and thin films of indium tin oxide (ITO) deposited by RF sputtering. Such devices have previously yielded conversion efficiencies of less than 5% but here, efficiencies of greater than 7% are reported. This is still poor by comparison with devices based on indium phosphide (InP)/ITO and the reason seems to be due to the excessive values and rather low activation energy (ΔE) of J_0. The variation of quantum efficiency with wavelength shows a peak at about 80% for a wavelength around 600 nm.

11172 **Method and apparatus for I-V data acquisition from solar cells.** Cole, S. W. (to The United States of America as represented by the Department of Energy). US Patent 4,528,503. 9 Jul 1985. Filed date 19 Mar 1981. vp.

PAT-APPL-245583.

A method and apparatus for logging current-voltage (I-V) characteristic data of a solar cell module in two modes using a portable instrument. One mode controls the load current through a circuit in 256 equal intervals while voltage is measured from open circuit to at least halfway into the knee of the curve and the other mode controls the load voltage through a circuit in 256 equal inter-

vals from the lowest voltage measurement possible (short circuit) to at least halfway into the knee of the curve, under control of a microcomputer. All measurements are packed by discarding each measurement that is within 0.5% of the value predicted from two previous measurements, except every ninth (9th) measurement which is retained. The remaining data is further packed into a memory block of a detachable storage medium by recording the data points in sequence following a header containing data common to all points, with each point having the value of the controlled parameter recorded as the number of increments from the previous point recorded followed by the measured value. The detachable storage medium is preferably a solid state device for reliability, and is transferable to a playback terminal which unpacks the data for analysis and display.

11173 **Biomass pyrolysis: a review of the literature. Part 1--carbohydrate pyrolysis.** Antal, M.J. (Univ. of Hawaii, Honolulu, HI). pp 61-111 of Advances in solar energy: an annual review of research and development, vol. 1. Boer, K.W.; Duffie, J.A. New York, NY; American Solar Energy Society Inc., (1984).

A normative review of the literature describing the products, mechanisms and rates of carbohydrate pyrolysis is presented. The role of a complex sequence of competing solid and vapor phase pyrolysi pathways is elucidated.

11174 **Effects of chloride depletion on electron donation from the water-oxidizing complex to the photosystem II reaction center as measured by the microsecond rise of chlorophyll fluorescence in isolated pea chloroplasts.** Itoh, S.; Yerkes, C.T.; Koike, H.; Robinson, H.H.; Crofts, A.R. (Univ. of Illinois, Urbana). *Biochimica et Biophysica Acta;* 766: 612-622(1984). Contract AC02-80ER10701.

P^+-680 reduction kinetics were measured by observing the microsecond rise kinetics of the change in chlorophyll fluorescence yield associated with the loss of P^+-680 as quencher using a method developed by Duysens et al. By studying the flash number dependence of P^+-680 re-reduction, the mechanism of inhibition of the oxygen-evolving complex by Cl^- depletion was investigated. Reactions, which occur over the microsecond range, are suggested whereby the reaction center of PS II changes its redox state in normal chloroplasts. It is shown that in chloroplasts incubated in Cl^--free medium, one reducing equivalent is available in addition to the electron transport component Z and P-680.

11175 **Excited state photoelectrochemical production of H_2O_2 and Br_2.** Neyhart, G.A.; Marshall, J.L.; Dressick, W.J.; Sullivan, B.P.; Watkins, P.A.; Meyer, T.J. (Univ. of North Carolina, Chapel Hill). *Journal of the Chemical Society, Chemical Communications;* 915-917(1982).

A cell is described here in which H_2O_2 and Br_2 are produced in acetonitrile solution with a high per proton quantum efficiency. The cell is based on reductive quenching of the metal-to-ligand charge transfer excited state of $(bpy)Os(das)^{2+}$, where bpy is 2,2'bipyridine and das is o-phenyl-bis(dimethylarsine), by $N(p\text{-}C_6H_4Br)_3(NAr_2)$ in acidic acetonitrile solution.

11176 **Charge-transfer luminescence from mixed-ligand, 2,2',2"-terpyridine-phosphine, complexes of osmium(II).** Allen, G.H.; Sullivan, B.P.; Meyer, T.J. (Univ. of North Carolina, Chapel Hill). *Journal of the Chemical Society, Chemical Communications;* 793-795(1981).

The first example of intense room temperature charge-transfer (CT) emission from a series of metal-terpyridine complexes ([Os/sup II/(trpy)(diphosph)L]/sup n/$^+$ (trpy = 2,2',2"-terpyridine and diphosph is, e.g., $Ph_2PPCH_2PPh_2$)) in fluid solution is reported; the complexes can have relatively long CT excited-state lifetimes while also exhibiting substitutional photochemistry.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 11120

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 11123, 11155, 11156

11177 **(PNL-SA—13507) Economic evaluations of solar thermal energy systems using a levelized energy cost approach.** Williams, T.A.; Dirks, J.A. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1985. Contract AC06-76RL01830. 14p. (CONF-851201—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004870.

From 7. Miami international conference on alternative energy sources; Miami Beach, FL, USA (9 Dec 1985).

This paper discusses a Levelized Energy Cost (LEC) approach to economic evaluations of solar thermal power plants. Levelized Energy Costs are life cycle costs that include a plant's capital cost, total operation and maintenance cost, taxes, interest, and return on investment. A LEC approach provides an economically correct treatment of these costs and allows an evaluation of alternative solar thermal power systems. In this paper, general economic principals relating to LEC calculations such as the time value of money, discount rate, net present value, and annualized cost are defined and explained. The use of LEC analyses in choosing between alternatives is discussed. Then the simplified approach for calculating an LEC using the standard economic assumptions for solar thermal applications is presented. Finally, a way to easily carry out the LEC calculation on a microcomputer is given.

11178 **(SAND—85-8249) Numerical modeling of a solid particle solar central receiver.** Evans, G.H.; Houf, W.G.; Greif, R.; Crowe, C. (Sandia National Labs., Livermore, CA (USA); California Univ., Berkeley (USA). Dept. of Mechanical Engineering; Washington State Univ., Pullman (USA). Dept. of Mechanical Engineering). Dec 1985. Contract AC04-76DR00789. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005066.

The flow of air and particles and the heat transfer inside a solar heated, open cavity containing a falling cloud of 100 to 1000 micron solid particles have been studied. Two-way momentum and thermal coupling between the particles and the air is included in the analysis along with the effects of radiative transport within the particle cloud, among the cavity surfaces, and between the cloud and the surfaces. The flow field is assumed to be two dimensional with steady mean quantities. The PSI-Cell (particle source in cell) computer code is used to describe the gas-particle interaction. The method of discrete ordinates is used to obtain the radiative transfer within the cloud. The results include the velocity and temperature profiles of the particles and the air. In addition, the thermal performance of the solid particle solar receiver has been determined as a function of the following particle parameters: size, mass flow rate, absorptivity, and infrared scattering albedo. Other parameters which have been varied include the incident solar flux (both magnitude and distribution) and receiver size. A forced flow, applied across the cavity aperture, has also been investigated as a means of decreasing convective heat loss from the cavity. Comparison of the results from the model has been made with an experiment performed at the radiant heat facility in Albuquerque. The model has also been used to predict the entrainment of air and the decrease in particle drag which has been observed when measurements were made of particle velocity in a cloud of particles in free fall.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 11121, 11197, 11414, 11415, 11416, 11445, 11445

11179 (CEER-X—163, pp vp) **Potential applications of solar energy in the Republic of Panama.** Pytlinski, J.T.; Soderstrom, K.G. (Univ. of Puerto Rico, San Juan). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The potential use of solar energy in the Republic of Panama is investigated. This use is heavily dependent on several factors. Some of them such as the availability of solar radiation over the year, process characteristics of selected industrial, commercial and agricultural operations, and matching requirements of solar systems thermal output with a particular process requirement were studied. During visits made in four provinces, Cocle, Herrera, Veraguas and Chiriqui, fourteen plants including meat packing, food processing, garment manufacturing, refreshment bottling, tobacco drying, coffee drying as well as a brewery, a hotel/restaurant, a school cafeteria, a sugar mill, a rice mill and a salt refinery, were identified as plants where solar energy could be used as an alternative energy source. The solar energy implementation program is composed of two phases: first, the installation and operation of demonstration/test systems, and second, large scale manufacturing and application programs. The study shows a good potential for solar energy use in its direct form or in the form of biomass in the following sectors of the Panamanian economy: industrial applications, commercial applications, educational institutions, health care institutions, and agricultural industry. The possible saving of fossil fuels by using solar energy in the Republic of Panama as derived from an analysis of individual applications in different sectors of the economy is discussed. The use of solar energy for water heating in these sectors is investigated in detail. 6 references, 5 figures, 7 tables.

11180 (CEER-X—163, pp vp) **Solar air conditioning.** Barcelo, H. (Univ. of Puerto Rico, San Juan). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The Center for Energy and Environment Research forms part of the University of Puerto Rico and is dedicated to research in the energy and environment fields. The laboratory and reactor buildings consist of 32,250 square feet of office and laboratory space. Because only about 40% is being used at present, the total air conditioning load for these buildings is of the order of 100 tons. A technical energy study was made and as a result of this study a proposal was presented with the purpose of installing an air conditioning system in which solar energy would be used to provide hot water for an absorption unit. System specifications, description, and control equipment are discussed.

11181 (CEER-X—163, pp vp) **Study of solar solid adsorption ice-maker using 13 X zeolite - water couple in tropical climate.** Dupont, M.; Nguyen, P.H.; Meunier, F. (CUAG, Pointe-a-Pitre Cedex, Guadeloupe). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Among the several ways to obtain cooling from solar energy, the intermittent solid adsorption system presents the following advantages: direct utilization of solar energy without any electric or mechanical conversion; no auxiliary source; complete autonomy without any mobile part; and large possibility for climatization and refrigeration depending on the working fluid and the sorbent properties. It has been shown that 13 X natural and synthetic zeolite are particularly efficient with water when using solar energy. Our purpose is to describe dynamic properties of a zeolite-water system under two different climates, a tropical one in Pointe-a-Pitre (Guadeloupe) and a temperate one in Montpelier (France). The experimental results are discussed through a modelization of heat and mass transfer in the flat plate collector containing the zeolite, the main part of the machine. 5 references, 6 figures.

11182 (CEER-X—163, pp vp) **Solar energy technologies in Puerto Rico.** Pytlinski, G. (Univ. of Puerto Rico, San Juan). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The development of solar energy in Puerto Rico is discussed. Even though funding for research programs has been reduced, special legislation allows implementation for Puerto Rico and the US Insular Areas. Examples of solar technologies being used and developed in Puerto Rico are described. These are solar water heaters on house tops and windows, solar-aided absorption cooling systems for office and commercial buildings, solar ponds and salt-gradient solar ponds for hot water, and residential photovoltaic systems. 7 figures.

11183 (CEER-X—163, pp vp) **Major design, and operational considerations of salt-gradient solar ponds.** Hull, J.R.; Cha, Y.S.; Sha, W.T. (Argonne National Lab., IL). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

A salt-gradient solar pond is a body of water containing a salt gradient in the upper part of the pond, such that salinity increases with depth. Sunlight is absorbed throughout the pond and especially on the pond bottom, raising the water temperature. Without the salt gradient the heated water at the pond bottom, finding itself less dense than the cooler water above it, would rise to the surface, where the heat would be lost. With the salt gradient the hot salty water at the bottom of the pond is more dense than the cooler, but less salty, water above it and therefore stays at the bottom. The prevention of convection in the upper part of the pond allows the bottom part of the pond to attain high temperatures, even reaching the boiling point in some ponds. Heat can be extracted from the hot brine at the bottom of the solar pond and used for space heating, domestic water heating, crop drying, low temperature process heating, desalination, and even electricity generation. The major considerations necessary for using salt-gradient solar ponds are discussed, based on the experience gained in the design, construction, and operation of the 1000 m^2 Research Salt Gradient Solar Pond at Argonne National Laboratory. 15 references, 6 figures.

11184 (CEER-X—163, pp vp) **Solar water heater for tropical countries.** Abillon, J.M.; Saldes, F.; Taverny, P.; Reimoneng, A. (Centre Universitaire Antilles, Guyane, French West Indies). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

In tropical and equatorial areas, the concept and design of solar water heaters is simplified for the following reasons: (1) mean annual ambient temperature varying from about 30°C during the day to about 20°C during the night, eliminating in a certain sense the necessity of thermal insulation, and (2) mean temperature of the main water at about 20°C to 26°C therefore diminishing the amount of hot water needed. One can then estimate the daily consumption of a four member family to 100 to 125 liters (26.4 to 33 US gallons) of 60°C hot water. A rather low cost solar water heater designed to fulfill these goals is presented. In part I this system and its performance is described. The problem of overnight water tank temperature losses is studied in order to improve the ability to maintain the temperature of the hot water at a reasonable level at sunrise. Part II describes the mathematical model keeping into account all the thermal transfer processes. Results of the simulation are shown in part III. 10 references, 2 figures, 1 table.

11185 **(CONF-850386—Pt.1) IEA Solar Task 8: Passive and hybrid use of solar energy.** Hastings, S.R. (ed.). (Bundesamt fuer Energiewirtschaft, Bern (Switzerland)). Mar 1985. 122p. (In German and French). NTIS (US Sales Only), PC A06/MF A01. File Number DE86770067.

From Passive and hybrid solar low energy building design - Swiss IEA results; Zurich, Switzerland (28 Mar 1985).

The international and Swiss research programs of IEA Solar VIII are presented. Both programs are divided into four work areas or subtasks: monitoring, simulation, design tools, and demonstration. For each subtask goals, methods, and findings are summarized from international and national work. More detailed information from the Swiss research is reported in subsequent chapters. For the 7 papers of this brochure a separate subject analysis is given.

11186 (CONF-850386—Pt.1, pp 13-25) **Measurements on 2 test cabins, one with glazed veranda and one with direct energy gain.** Spinedi, C. Mar 1985. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86770067.

From Passive and hybrid solar low energy building design - Swiss IEA results; Zurich, Switzerland (28 Mar 1985).

Within the framework of the IEA project 'Passive and hybrid solar low-energy buildings', two test units were constructed and equipped with measuring instruments in Lugano. The project aims to measure in experiments the thermic behaviour of a unit with a buffer zone in comparison with one where energy is gained directly through a window. This paper describes in brief the cabins, the measuring equipment and the measurement strategy, after which some of the results gained from the experiments are discussed.

11187 (CONF-850386—Pt.1, pp 67-75) **Handbook on the utilisation of solar energy in buildings.** Zimmermann, M. Mar 1985. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86770067.

From Passive and hybrid solar low energy building design - Swiss IEA results; Zurich, Switzerland (28 Mar 1985).

The advantages of passive solar energy utilisation in regard to the amount of energy used for heating and comfort are undeniable. However, suitable and if possible, simple planning aids will have to be available if this technology is to be put to evidespread use. A handbook on passive solar energy utilisation in buildings is intended as an important contribution toward this. The manual sums up the present knowledge on passive solar energy utilisation as far as it is applicable to Switzerland and complements this with up-to-date, practically oriented results from the IEC-Task VIII research work. For an in-depth analysis of the energy budget, it also contains calculation methods based on the familiar energy account according to SIA.

11188 (CONF-850386—Pt.1, pp 77-95) **Evaluation of five methods of dimensioning passive solar systems.** Perrin, G.R. Mar 1985. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE86770067.

From Passive and hybrid solar low energy building design - Swiss IEA results; Zurich, Switzerland (28 Mar 1985).

A number of calculation programmes and design aids have been developed for a rational approach to the dimensioning of passive solar systems. The adaptation of such programmes to the actual requirements of architects and engineers is to be treated with caution. The growing number of such products appearing on the market may have more than one user in some perplexity. This research study attempts an evaluation on the basis of a limited number of criteria of 5 calculation models for the dimensioning of passive solar energy systems. Programmes for micro-computers which are well-documented and representing various different mathematical approaches were selected. Each of the models was used to simulate the thermic behaviour of one, two or three passive solar systems. The figures that came out in the results were compared to measured values (temperatures) or simulated values (energy account) with the aid of validated dynamic programmes such as SERIRES or DEROB. The assessment of this study gives rise not only to evaluation criteria for the five models tested, but also to some thoughts on simulation which fix the limits on the use of these products rather more precisely.

11189 (CONF-8410367—, pp 119-122) **Planning and operating instructions for agricultural batch drying machinery with air-pre-heating by means of solar energy.** Grimm, W.; Luecke, W. 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE86770072.

From 42. international meeting on agricultural technology; Neu-Ulm, F.R. Germany (25 Oct 1984).

The use of solar energy for drying hay and arable crops is of special interest for agriculture. The combination of low-cost collectors integrated into roofs with batch drying machinery is a good way of encouraging the trend among many small and medium-sized farms to store and treat their own cereals for sale. As an example it is shown how to tackle the construction and dimensioning of a cereal batch drying plant with air pre-heating by means of solar energy. The planning criteria that have to be observed are listed.

11190 (DOE/CS/30350—T1) **Performance of the RPI Passive Solar Visitors Information Center Building for 1982.** Tichy, J.A. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Mechanical Engineering). 1984. Contract FC02-80CS30350. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004980.

A performance evaluation of the RPI Passive Solar Visitors Center is presented. Data have been taken and analyzed for January through December 1982. The yearly total energy use is 58.9 MW-h/y (201 MBtu/y), or on a per unit floor area basis, 123 kW-h/m²-y (38.7 kBtu/ft²-y). These figures agree reasonably well with updated simulation, rather than design simulation, provided realistic values for the interior thermostat set points are used. This energy use represents a 70% reduction in total energy consumption relative to standards of the New York State Energy Conservation Construction Code (construction regulations meant to ensure that energy use in new buildings is below certain values).

11191 (DOE/CS/30350—T2) **RPI visitors center.** Kroner, W.M. (Rensselaer Polytechnic Inst., Troy, NY (USA). Center for Architectural Research). 1981. Contract FC02-80CS30350. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004978.

A brief description of the background and construction of the RPI visitors center is provided. The building design incorporates passive solar heating, cooling, and daylighting systems. (BCS)

11192 (DOE/CS/30350—T3) **DOE passive solar commerical buildings program. Final technical report.** (Rensselaer Polytechnic Inst., Troy, NY (USA). Visitors Information Center). Jan 1985. Contract FC02-80CS30350. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004505.

Brief discussions on the construction verification and performance analysis of the RPI Visitors Information Center are presented. The owner's and the designer's perspectives are included along with recommendations. Information dissemination activities are summarized. (BCS)

11193 (DOE/CS/30350—T4) **Report summarizing the results of constructing a passive solar building for the campus of Rensselaer Polytechnic Institute, Troy, New York.** (Rensselaer Polytechnic Inst., Troy, NY (USA). Center for Architectural Research). [1985]. Contract FC02-80CS30350. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004981.

On April 10, 1981, RPI's Visitor Information Center was officially dedicated. Through the remainder of the year the Office of Physical Facilities and the project design team devoted considerable time to debugging and fine-tuning the facility. This latter activity was unexpected and prevented the design team from obtaining useful evaluation results. This project caused an awareness that debugging a passive solar building requires almost a full year's cycle to insure that all systems and controls are, in fact, functioning the way they were designed. In addition, problems with moveable insulation and damper controls continued until December 1981 which are primarily due to faulty design. As a result, only partial performance evaluation data could be obtained in 1981.

11194 (DOE/CS/30522—1) **Passive solar greenhouse. Final technical report.** (Four Seasons Solar Products Corp., Farmingdale, NY (USA)). 8 Aug 1984. Contract FC02-80CS30522. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86004925.

The development of a glazing system to be used as an efficient passive solar collector is presented. The design of the system is an attached greenhouse providing not only heat, but also the abil-

ity to produce food, capture light and enclose space. Automatic ventilation and night insulation along with heavy emphasis on aesthetics and market acceptability are incorporated into the design. (BCS)

11195 **(PB—85-240216/XAB) Solar and energy-conserving food technologies: a training manual.** Elliot, J.; Goldman, L. (Peace Corps, Washington, DC (USA). Information Collection and Exchange). 1985. 155p. (PC/ICE/T—17). NTIS, PC A08/MF A01.

The report is designed to help plan and implement in-service trainings in solar and other energy-conserving food technologies. It focuses on design, construction, and use of solar dryers for fruits, vegetables, meat, fish and herbs, along with fireless cookery. It emphasizes integrating technical and nontechnical information.

11196 **Passive solar heating research.** Balcomb, J.D. (Los Alamos National Lab., Los Alamos, NM). pp 265-304 of Advances in solar energy: an annual review of research and development, vol. 1. Boer, K.W.; Duffie, J.A. New York, NY; American Solar Energy Society Inc. (1983).

Key elements of research into the passive solar heating of buildings are described and examples ar given to illustrate how research in the field has been approached. The major emphasis of the research has been on devising mathematical models to characterize heat flow within buildings, on the validation of these models by comparison with test results, and on the subsequent use of the models to investigate both the influence of various design parameters and the weather on system performance. Results fro both test modules and monitored buildings are given. Simulation analysis and the development of simplified methods are described.

1410 Solar Collectors And Concentrators

11197 (CONF-8410367—, pp 117-118) **Development of simple air collectors for drying agricultural produce in developing countries.** Lutz, K. 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE86770072.

From 42. international meeting on agricultural technology; Neu-Ulm, F.R. Germany (25 Oct 1984).

Within the scope of German-Greek co-operation in the field of solar energy use, solar drying plants were developed for agricultural produce. The aim was to reduce the loss of mass which usually occurs with the methods pracitsed hitherto of drying on the ground, and to improve the quality of the produce. The essential component of the solar plant is the air collector in which the air for the drying process is heated up to the required temperature in order to extract moisture. The author goes into the operational behaviour of the air collectors and their long-term performance. The results obtained show applicability also in arid and semiarid locations.

11198 **Applications of maximally concentrating optics for solar energy collection.** O'Gallagher, J.; Winston, R. (Univ. of Chicago, IL). *AIP (American Institute of Physics) Conference Proceedings;* No. 135, 448-471(1985). (CONF-850414—). Contract AC02-80ER10575;AC03-82SF11655;FG02-84CH10201.

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

A new family of optical concentrators based on a general nonimaging design principle for maximizing the geometric concentration for radiation with a given acceptance half angle was developed. The maximum limit exceeds by factors of 2 to 10 that attainable by systems using focusing optics. The wide acceptance angles permitted using these techniques have several unique advantages for solar concentrators including the elimination of the diurnal tracking requirement at intermediate concentrations (up to $\approx 10\times$), collection of circumsolar and some diffuse radiation, and relaxed tolerances. Because of these advantages, these types of concentrators have applications in solar energy wherever concentration is desired, e.g., for a wide variety of both thermal and photovoltaic uses. The basic principles of nonimaging optical design are reviewed. Selected configurations for thermal collector applications are discussed and the use of nonimaging elements as secondary concentrators is illustrated in the context of higher concentration applications. 15 references, 12 figures.

1420 Heat Storage

REFER ALSO TO CITATION(S) 11190

15 GEOTHERMAL ENERGY

11199 **(CONF-8509142—) Geothermal Program Review IV: proceedings.** (Meridian Corp., Falls Church, VA (USA)). 1985. 188p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86004074.

From Geothermal program review; Washington, DC, USA (11 Sep 1985).

The research and development program of DOE's Geothermal Technology Division is reviewed in separate presentations according to program area. Separate abstracts have been prepared for the individual papers. (ACR)

1501 Resource Status And Assessment

11200 **(UCRL—15535-Vol.7) Impact of geothermal development on the state of Hawaii. Executive summary. Volume 7.** Siegel, B.Z. (Hawaii Univ., Honolulu (USA)). Jun 1980. Contract W-7405-ENG-48. 97p. NTIS PC A05/MF A01. File Number DE83012950.

Questions regarding the sociological, legal, environmental, and geological concerns associated with the development of geothermal resources in the Hawaiian Islands are addressed in this summary report. Major social changes, environmental degradation, legal and economic constraints, seismicity, subsidence, changes in volcanic activity, accidents, and ground water contamination are not major problems with the present state of development, however, the present single well does not provide sufficient data for extrapolation. (ACR)

1504 Legal And Institutional Aspects

REFER ALSO TO CITATION(S) 11200

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 11200

1508 Geothermal Power Plants

11201 **(LA-UR—85-4332) Present status of hot dry rock technology.** Nunz, G.J.; Franke, P.R. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 6p. (CONF-851201—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004741.

From 7. Miami international conference on alternative energy sources; Miami Beach, FL, USA (9 Dec 1985).

The field experiments have been conducted principally at Fenton Hill, New Mexico. The completed phase I confirmed the technical feasibility of the HDR concept by creating a small hydraulically fractured reservoir and extracting heat from it for over a year at rates up to 5 megawatts. The second phase extends the technology to the creation and operation of an industrial-scale HDR system that will produce heat at a temperature and rate suitable for producing electricity, with thermal drawdown of less than 20% in 10 years. Operations have created three-dimensional fractured volumes capable of producing at least 35 MW(t) for not less than 10 years. Design, procurement, and construction of the phase II surface system is proceeding in preparation for an initial closed-loop flow test of two to four weeks duration in the third quarter of FY 1986. (ACR)

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 11201

11202 **(BRGM—83-SGN-885-IRG) Identification of the response parameters of a geothermal field during a non-isothermal short time water injection test.** Menjoz, A. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). 1983. 47p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE86750439.

Various methods to analyse the effect of a non-isotherme water injection on the pressure evolution during a test on a double geothermal well are investigated. Then, several types of injection test are simulated with experimental data to examine the conditions of application of these interpretation methods.

1520 Geothermal Data And Theory

11203 **(BRGM—84-SGN-143-GTH) Study in applied geochemistry. Geothermal water.** Ouzounian, G. (Bureau de Recherches Geologiques et Minieres (BRGM), 45 - Orleans (France)). Mar 1984. 22p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750435.

The chemical analysis of the water of the Teich-Pirac geothermal well is studied. The risk of iron sulfide precipitation has been established. Recommendations to limit their effect are presented.

17 WIND ENERGY

1701 Availability (climatology)

11204 (CEER-X—163, pp vp) **Potential of wind energy in Rajasthan state (India): a case study.** Jagadeesh, A.; Varshneya, N.C. (Univ. of Roorkee, India). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

An analysis of the data available at 13 Meteorological stations in Rajasthan state shows that wind velocities are moderate in the whole of the state. High wind speeds are experienced in Pholodi, Jodhpur, Jaipur and Jaisalmer. The winds are strong during the south West Monsoon months (May-September) which account for 75% of the annual wind energy flux. The study of the potential of wind energy in the state indicate that it is higher than the electricity consumed in the state. Application of wind energy to lift water for irrigation and drinking purposes is suggested in the drought prone districts of Jaisalmer, Jodhpur, Barmer and Bikaner. Reducing the cost of generation of wind energy through escarpments is highlighted in the paper. 18 references, 6 tables.

11205 (CEER-X—163, pp vp) **Correlations between short term and long term wind observation data in Ceer Toa Baja energy experimental farm.** Iriarte, M.; Betancourt, J.H.H. (Univ. of Puerto Rico, San Juan). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Potential users of small wind mills are often discouraged by the need of a long period of data collection (at least one year) to determine the economic viability of their particular project. However, sometimes there is in the general region of the prospective site a National Weather Service station or a similar installation having historic data on wind speed and direction. If, somehow, use could be made of this information after modifying it to account for obstructions in the wind's path, the period of wind data gathering at the proposed site could be shortened to a large extent. Halpering and Beckman described such a method. A digital computer program has been developed by the Center for Energy and Environment Research (CEER) of the University of Puerto Rico to perform the calculations required by this method. Also, after thoroughly testing the program, it has been applied to about 1.6 months of data available from the CEER Toa Baja Energy Experimental Farm. The nearby Palo Seco, Toa Baja facility of the P.R. Electric Power Authority (PREPA) was used as the long term data source. The method requires that the hourly wind speed be collected simultaneously at the prospective site (CEER) and at the known site (PREPA) for three months. Wind direction needs only be collected at the known site. The median value of the ratios between wind speed at the CEER site and the PREPA site are taken as correlation ratios for 16 wind directions recorded at the PREPA site. These correlation ratios are used to predict the long-term speed duration curve of the CEER site from the data at the PREPA site. Using this curve, the CEER site long-term average wind power density is also predicted. 3 references, 10 tables.

11206 (CEER-X—163, pp vp) **Design of a centralized network for data acquisition of wind, solar and environmental parameters by using the existing radio telemetry seismic network in Puerto Rico.** Iriarte, M. Jr.; Ramirez, A.; Betancourt, J.H. (Univ. of Puerto Rico, San Juan). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

A seismic network was operated and maintained in Puerto Rico from 1974 to 1978. Since it was recognized that additional data would be required during the next decade, interested government agencies are cooperating to arrange for long term operation. It is also desirable to use the existing base to expand into a meteorological and environmental data gathering system. The two methods available for transmission of this type of data are discussed: continuous data transmission by time division multiplexing and non-continuous data transmission by local logging, storing, and periodic transmission. 4 references, 6 figures.

1704 Economics

REFER ALSO TO CITATION(S) 11204, 11205

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 11205, 11445

11207 (CEER-X—163, pp vp) **Energy recovered by using balloons and cylinders.** James, G.D. (Los Angeles City College, CA). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

Wind energy can be recovered by placing two balloons immediately over one another on the same line (cable), with pockets (sails) placed to make them turn in opposite directions. A mechanical to electrical converter is placed between the two balloons. This device may change the role of wind energy from that of a minor source of energy, (special locations and uses) to a major source of energy. The balloons can lift holding cables much higher than normal towers can be built. The height of the balloons can be varied according to wind speed. The balloons can be reeled in during storms. The unit can be taken (flown by helicopter) to a location, an anchor built, the balloons inflated and minutes later, electricity is arriving at the anchor point. Used by ship owners, the balloons not only provide electricity, but serve as a sail. Inexpensive, do-it-yourself, applications might result in a greater use of wind in pumping water from wells. The low cost anticipated should enable the system to be located in a much larger area of the world than presently appears to be possible. A modification of the system might make it economical to recover energy from river and ocean currents. 15 figures.

11208 (CEER-X—163, pp vp) **Community supported wind resource monitoring network.** D'Aquanni, R.T. (DSD Associates, North Conway, NH). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The use of recording anemometry to record long term on-site wind speed characteristics is the final and most important step in assessing the potential economics of each site and its value to a neighboring utility or other purchasers. It is at this point that the network of participants, i.e. potential wind machine owners, become active. The significant work to be reported in this paper concentrates on the on-site monitoring and analysis. Participants are primarily farmers, members of the Carroll County Farm Bureau. The poorest community in New Hampshire, Carroll County, is located in the mountains of New England, has a large agricultural sector and is similar to Puerto Rico in that it is designated as a high potential wind area by Battelle Pacific Northwest Laboratory in their recently published Wind Energy Atlas. Seventeen wind monitoring stations outfitted with self-installed towers and self-programmed recorders are dispersed throughout Carroll County's approximate 250,000 acres. A wide diversity of farm loads including water pumping, compressors for milking cows and cooling apples, and systems for heating water and spaces in homes, barns and greenhouses are analyzed. Diurnal and seasonal wind patterns are analyzed to determine the coincidence of the wind on-site electric loads and utility peaks. The frequency distribution of the wind speeds are recorded according to American Wind Energy Association interim standards to better predict the energy available from the wind. Wind shear profiles are analyzed using a calibrated digital kite to better place machines on sites with minimum turbulence.

11209 **Current methods for the dynamic analysis of horizontal axis wind turbines.** Thresher, R.W. (Solar Energy Research Institute, Golden, CO). *AIP (American Institute of Physics) Conference Proceedings;* No. 135, 472-496(1985). (CONF-850414—).

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

Current methods for the dynamic analysis of horizontal axis wind turbines are explored. The paper first introduces the reader to typical wind-turbine configurations and provides background on the current status of the wind industry. Blade element aerodynamic analysis is covered first, with insight into the current status of aerodynamic analysis methods. Next, the importance of resonant vibration analysis is discussed. Forced dynamic analysis is the final analysis area to be addressed. The dynamic analysis computer code FLAP (Force and Loads Analysis Program) is discussed in some detail to give the reader a clear idea of the level and complexity of blade dynamics. Current areas of research and advanced wind-turbine designs are the final subjects considered. These are intended to give the reader some idea of how the technology will progress during the next five to ten years. In closing, the reason that leads researchers to believe that wind technology can be significantly improved through a better knowledge of their dynamic behavior are discussed. 25 references, 13 figures, 2 tables.

20 ELECTRIC POWER ENGINEERING

11210 **(AI/DS/TR—1010-1) Information structures for the control of large scale systems. Final technical report, September 1980-March 1984.** Chong, C.Y.; Mori, S.; Tse, E. (Advanced Information and Decision Systems, Mountain View, CA (USA)). May 1984. Contract AC01-80RA50423. 200p. NTIS, PC A09/MF A01; GPO Dep. File Number DE86004773.

Section 2 considers the implicit channels of communication and signaling strategies. By expanding the class of strategies, almost all channels would work. For linear systems with a special class of signaling strategies, namely, decentralized linear time invariant feedback, the completeness of the channel is needed. Section 3 investigates the decentralized control of linear systems. In systems with a special structure, namely the acyclic structure, the implicit network, though present, is not used. Signaling does not improve the performance of the system. Thus, the resulting control laws are fairly simple and can be computed in a sequential manner. In strongly connected systems, the agents are so tightly coupled that by signaling the system can be controlled from any agent. Such systems are thus natural candidates for centralized control. Section 4 considers the decentralized control of interconnected systems. Results for static and dynamic interconnections are given. When the exact values of the parameters in the system are not known, some structural properties in decentralized control are presented in Section 5. The concept of structural completeness is introduced and characterized. Section 6 reports a separation result on decentralized control. Emphasis in Section 7 shifts to the distributed estimation problem. Optimal fusion strategies for each agent to process the data are given for arbitrary communication networks. The current research in decentralized control is motivated by Witsenhausen's counterexample. A numerical solution to Witsenhausen's example is given in Section 8. The last two sections focus on the a priori structure of the control problem and attempt to relate the abstract decentralized control problem to some economic like models.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 10746, 10756, 10835, 10845, 10890, 10891, 10892, 10894, 11128, 11146, 11244, 11246

11211 (CONF-8410367—, pp 223-233) **Using agricultural waste in gas generators and its importance for developing countries.** Kaupp, A.; Bloh, H. v. 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE86770072.

From 42. international meeting on agricultural technology; Neu-Ulm, F.R. Germany (25 Oct 1984).

This is a commentary on the world-wide experience of the international 'Producer Gas Round Table' as it has been put into practice in technology in the Third World, basing itself upon one of the most comprehensive studies made on the level science had reached in gas generator technology at a performance range of 5 to 500 kWsub(el), which was done between 1980 and 1984. The summary concentrates particularly on a cross-sectional analysis of the regulations and constraints placed upon technology and the minimum requirements that systems for the gasification of agricultural and forestry waste should be able to fulfil.

11212 (DOE/ET/17086—1932, pp 2.49-2.101) **On-line measurements of fouling and slagging (full-scale and pilot units) and correlation with predictive indices in conventionally fired steam generators.** Bryers, R.W. Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

Most of the work done on characterizing the fireside behavior of mineral matter in coal has been directed at predicting the fusibility of ash in terms of its elemental composition. The data are most applicable to high heat release rate furnaces where the ash deposit is most vulnerable to liquefaction. The data are used for defining furnace exit temperature and selecting furnace volumes. Specific dimensions and geometry are empirical and proprietary. A smaller portion of the research effort has been directed at convective heat exchanger fouling. Sodium has been identified as the single most important constituent. Since fouling is initiated by a condensation mechanism, it is logical that fouling indices be based on sodium levels in the coal or coal ash. The impact of mineral forms and ash levels on fouling due to sodium is still uncertain. Calcium reduces fouling, the exact level is uncertain. 36 refs., 19 figs., 6 tabs.

11213 (DOE/ET/17086—1932, pp 2.103-2.110) **Predicting and assessing tube metal wastage in boilers fired with low-rank coal.** Plumley, A.L. (Combustion Engineering, Inc., Windsor, CT). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

There are three potential problem areas where external corrosion may be found in utility and industrial boilers firing coal. Wastage has occurred on waterwalls near the firing zone, in the high temperature superheater and reheater section, and in low temperature gas passes and air heaters. In all three areas the presence of sulfur is required for corrosion to occur. Based on an understanding of the corrosion process, as outlined in the previous section, work was undertaken by C-E and West Virginia University to quantify the effects of specific coal ash constituents on high temperature corrosion. Certain relationships were developed between coal

ash constituents and the degree to which they affect corrosion rates. The study has shown that the alkalies, alkaline earths, iron, and sulfur were the most significant constituents relative to high temperature corrosion. It was significant that the alkali concentration had been measured by an acid leaching process. Such a procedure was found to give a better measure of the simpler forms of sodium and potassium than total alkali measurements. There simpler forms of the alkalies are thought to be more available for reaction in forming alkali-iron-trisulfate. K_3 or $Na_3Fe(SO_4)_3$, the species directly responsible for tube wastage according to previous investigation by C-E and others. Since the alkalies are generally the least plentiful of the four constituents mentioned above, they are usually the most sensitive corrosion indicators. The alkaline earth materials are important as they may preferentially retain alkalies as sulfates or double salts of the type $K_2Ca_2(SO_4)_3$, thus preventing formation of the aggressive compound $K_3Fe(SO_4)_3$. By considering the combined effect of each of the constituents discussed, a nomograph was constructed to conveniently relate coal constituents to corrosion rates.

11214 (DOE/ET/17086—1932, pp 2.111-2.117) **Modelling of heat transfer and furnace conditions in pulverised coal fired boilers.** Higgins, R.S. (State Electricity Commission of Victoria, Australia). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

The SECV has developed mathematical models to provide an enhanced ability to estimate the performance and assess the design of new boiler furnaces, and to study the operating performance of existing plant. In the model, the furnace is divided into a number of gas and surface zones, within which all properties are considered to be constant. The prediction is carried out in two stages. In the first, the gas zones form a network of modified well-stirred reactors, arranged so that the flow through the network simulates the assumed bulk flow of fuel and gas through the furnace. Fuel burnout and heat release distribution is calculated using an assumed temperature distribution. The second stage uses the Zone Method to calculate the temperature and heat flux distributions using the assumed flow pattern and the calculated heat release distribution. The final prediction is obtained by iterating between the two stages of the model. The model ws validated by comparing predictive calculations of burnout and heat transfer with measurements taken in a brown coal fired boiler of 350 MWe output for full load and several part-load conditions. This assessment of furnace reponse to ash fouling is limited to consideration of relative differences between furnaces; realistic values must be provided for the thermal characteristic of deposits and caution must be exercised because of uncertainty over the relative fouling behavior of different coals. This detailed furnace heat transfer model provides a useful tool for comparative assessment of furnace designs in relation to fouling behavior.

11215 (EPRI-CS—4329-SR) **Seminar proceedings: prevention of condenser failures - the state of the art.** Syrett, B.C. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1985. 491p. (CONF-8411225—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920099.

From Seminar on prevention of condenser failures-the state of the art; Palo Alto, CA, USA (13 Nov 1984).

The 21 presentations summarized in this report offer up-to-date guidance to design engineers, plant engineers and chemists, condenser vendors, and others interested in minimizing failures in power plant steam condensers. Among the highlights are case histories of condenser failures and their countermeasures from Scandinavia, Great Britain, and the United States.

11216 (INIS-mf—10008, pp 31-35) **Utilization of conventional and nuclear power plant reliability information systems.** Ochrana, L. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The basic equation is given for time distribution in power production. Monitoring time is given by the sum of operation time, standby time, failure time, time of planned maintenance, time of long-term outages (reconstruction) and idle time owing to other causes. The relations are given for the different time components monitored. The reliability indicators used in power industry are defined and the reliability of power plants is evaluated using a computer.

11217 (INIS-mf—10008, pp 26-30) **Reliability information system for conventional and nuclear power plants.** Jira, S. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

Subsystems of a reliability information system with feedback are given. The said system was introduced for steam power production units. The collection of primary reliability information is made through the so-called monthly reliability reports which are filled in the department of operation analyses. Primary reliability data are stored on the disk memories of the ASVT computer. The system was also used in the establishment and implementation of the reliability information system for nuclear power plants with WWER 440 reactors. The existing classification of manifestations, causes and mechanisms of failures was analysed, mainly with regard to the effect of the human factor. An introductory study is now being compiled relating to the reliability information system for WWER 1000 nuclear power plants. The possibility has appeared of speedily designing and implementing a reliability information system for district heating systems.

11218 (SAND—85-1558) **Analysis of a customer-side-of-the-meter storage battery facility.** Murphy, K.D. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1985. Contract AC04-76DP00789. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86003442.

This report describes an analysis of a customer-side-of-the-meter (CSOM) storage battery facility from the financial risk viewpoint. A risk-adjusted rate of return was determined using the Capital Asset Pricing Model, and that rate was applied in an analysis of a site-specific CSOM facility design for a textile manufacturer. A sensitivity analysis of net present value to changes in the on-peak demand charge rate and the demand charge escalation rate was performed. Sensitivity analysis results were quantified by calculating coefficients of variation. The results show that the CSOM facility project is riskier than originally thought.

2002 Environmental Control Technology

REFER ALSO TO CITATION(S) 10788, 10899, 10911, 11909

11219 (DOE/ET/17086—1932, pp 3.1-3.24) **Environmental control technology.** Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

The fourteen participants in the Environmental Control Technology Workshop included three representatives from government research facilities, eight representatives from private sector research, engineering, or vendor firms, two representatives from the utility sector (including EPRI), and one from academia. The background statements which had been prepared on the agenda topics were used as a starting point for the discussion. Table 3-1 lists the agenda topics and indicates the prepared presentations that were given to initiate discussions. Each of the proposed research topics was discussed at the workshop, and a concensus was reached as to the need for further research in each of the topics. Some of the original research topics were dropped and others were added in the course of the discussions. At the close of the discussions, all of the agreed-upon research topics were rated as either higher or lower priority. The research topics, with priority rankings, are listed in Table 3-2.

11220 (DOE/ET/17086—1932, pp 3.25-3.37) **Modeling of spray dryer desulfurization.** O'Brien, T.J. (Morgantown Energy Technology Center, WV). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

The specific goal of the project is to develop a comprehensive computer model which will realistically describe the fundamental physical and chemical processes of the device. The dominant process is the fluid dynamics. The flow patterns (recirculation, detachment, etc.) must be described accurately. Moreover, the gas phase component distribution (concentration) and energy balance (temperature) must be well represented since they will determine the drying and absorption processes. The hydrodynamics is treated by solution of coupled partial differential equations. The dynamics of the second condensed phase must also be described accurately. The motion of the phases is strongly coupled, both mechanically and thermally. Particle-particle interactions (collisions) are important as they effect particle size (agglomeration) and evaporation (rewetting). Obviously, a major concern is determining which factors reduce interactions of (wet) particles with the walls. The novel aspect of this modeling activity is the incorporation of the droplet evaporation/absorption submodel. The slurry droplets are heated by the gas and cooled by evaporation. These processes are related to the local temperature, H_2O partial pressure of the gas and the temperature history of the drop. Again, the droplet size is a crucial parameter. Eventually, the basic point of this activity must be addressed, that of SO_2 absorption. This process is closely related to the drying process. The analysis of droplet chemistry, in the initial wet phase, is similar to that of a wet scrubber. It is dominated by gas/liquid mass transfer which is chemically enhanced by rapid acid/base reactions. However, this will become more complicated as (and if) factors such as lime dissolution and crust formation become important and, perhaps, dominant.

11221 (DOE/ET/17086—1932, pp 3.39-3.78) **NO/sub x/ formation and control in pulverized-coal flames.** Payne, R.; Heap, M.P.; Pershing, D.W. (Energy and Environmental Research Corp., Santa Ana, CA). Feb 1982. NTIS, PC A22/MF A01. File Number DE86000823. (CONF-8106235—).

From Workshop on low-rank coal technology development; San Antonio, TX, USA (17 Jun 1981).

Nitrogen oxide formation in pulverized-coal flames is strongly dependent upon oxygen availability in the early stages of heat release. The combustion of pulverized coal results in the formation of nitric oxide, either by the fixation of molecular nitrogen (thermal NO) or by the oxidation of coal-bound nitrogen (fuel NO). The formation of thermal NO is extremely sensitive to flame temperature; however, flame temperature has only a relatively small effect on fuel NO formation. Consequently, it is important to establish the source of the nitric oxide produced in coal flames because of the impact on potential control strategies. This also applies to the source of nitrogen for fuel NO formation. When a pulverized-coal particle/air suspension is injected via a burner into a combustion chamber in such a manner to produce a stable flame, the coal particles decompose as they are heated and reactions occur at a rate determined by the thermal and gaseous environment: the fuel-bound nitrogen is split between the char and the volatile fractions. The volatile fractions composed of tars and light gases decompose further, producing gas-phase nitrogen compounds and soot. For simplicity, fuel-bound nitrogen can be considered as two components: char nitrogen and volatile nitrogen. Char nitrogen is that which is associated with the solid, either as a pyrolysis product of the tars or as the original coal char; and gas-phase volatile nitrogen is that which is produced from the volatile coal fractions and reacts in the gas phase forming N_2, NO, NH_3, or HCN. This paper discusses the mechanisms of nitric oxide formation, the importance of fuel nitrogen, the impact of coal properties on fuel nitrogen formation and the methods of controlling nitric oxide formation in pulverized-coal flames. 11 refs., 18 figs., 1 tab.

11222 (EPRI-CS—4382) **Ceramic filter elements for high-pressure, high-temperature gases.** Lippert, T.E.; Ciliberti, D.F. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Technology Div.). Jan 1986. 61p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920124.

A single Schumacher porous ceramic tube (candle) filter was tested over 2005 operating cycles with a cumulative 260 hrs of operation at high temperature (815°C) and high pressure (11 atm) (HTHP) to evaluate filter cleaning operating characteristics. The candle was tested by feeding redispersed fly ash to the filter and then cleaning the filter online by reverse pulse jet method. The candle was subjected to approximately 35 shutdowns and cold restarts respectively. The operating characteristics of the filter were evaluated by calculating the effective permeability of the filter following each pulse cleaning cycle. Effective permeability is the operating filter face velocity divided by the baseline pressure drop measured across the filter. A summary of these data are shown plotted in Figure S.1. The data are averaged test points taken over the 2005 cycle test period. The solid curve drawn through the data points is a least squares regression fit that is intended to represent the trend in the data and should not be extrapolated. The general trend in the data and curve suggests a steep initial decrease in the filter permeability followed by a slowing and more gradual loss. This region covers about 1000 operating cycles and appears to correspond to a filter conditioning period where filter permeability can be expected to decrease by a factor of about 2.5. Beyond the filter conditioning period, there were extended operating periods where the measured permeability of the filter appeared to be basically constant suggesting stable cleaning and filter conditions. 3 refs., 26 figs., 3 tabs.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 11856

11223 (ORNL/TM—9758) **Athens automation and control experiment project review meeting, Dallas, Texas, December 5-6, 1984.** Detwiler, J.S.; Hu, P.S.; Lawler, J.S.; Markel, L.C.; McIntyre, J.M.; McKinley, K.F.; Monteen, L.D.; Purucker, S.L.; Reed, J.H.; Rizy, D.T. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 256p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE86005257.

The AACE is an electric power distribution automation project involving research and development of both hardware and software. Equipment for the project is being installed on the electric distribution system of the Athens Utilities Board (AUB), located in Athens, Tennessee. Purposes of the AACE are to develop and test load control, volt/var control, and system reconfiguration capabilities on an electric distribution system and to transfer what is learned to the electric utility industry. Expected benefits include deferral of costly power generation plants and increased electric service reliability. A project review meeting was held to review the progress of the AACE and to communicate the objectives and experimental plans to the electric utility industry. At the time of the meeting, the experimental test plans were being written; much of the AACE field equipment had been received by AUB, and installation had begun. A computer system, the AACE Test System (AACETS), was already operational at ORNL. AACETS will be used to develop and test applications software and experimental control strategies prior to their implementation on the AUB system. The AACE experiments are scheduled to begin in October 1985 and to continue through October 1987.

11224 **The application of synchronous clocks for power system fault location, control and protection.** Esztergalyos, J.; Andres, J.N.; Erickson, D.C. (Bonneville Power Administration, Portland, OR). pp 437-441 of Proceedings of the American power conference, vol. 46. Armington, R.E. Chicago, IL; Illinois Inst. of Technology (Apr 1984). (CONF-840412—).

From American power conference; Chicago, IL, USA (24 Apr 1984).

Recent developments in fault locating technology by the Bonneville Power Administration (BPA) on its 500-kV System provide a unique opportunity for major advancements in the science of fault location, power system control and protection. A most significant advancement is the installation of highly accurate synchronous clocks of microsecond accuracy at major 500-kV substations. Initially, these clocks will be synch-pulsed from a master oscillator at BPA's Dittmer Control Center, but future plans include the use of satellites for synch-pulsing. By using the synchronous clocks to measure the traveling voltage wave time at line end terminals, a microsecond accuracy gives 300 meter fault locating resolution. Relaying performance will be enhanced on reclose once the location of the fault is known. In addition, reclose selection based on fault location and fault evaluation will be possible. Synchronous time measurement of the sinusodial voltage at the zero crossing allows for the calculation of the generator angle and its rate of change between two or more locations. This will open up new approaches in system steady-state and transient stability control.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 11216

11225 (BNL-NUREG—37186) Structural load combinations. Hwang, H.; Reich, M.; Ellingwood, B.; Shinozuka, M. (Brookhaven National Lab., Upton, NY (USA); National Bureau of Standards, Washington, DC (USA); Columbia Univ., New York (USA)). 1985. Contract AC02-76CH00016. 26p. (CONF-8510173—33). NTIS, PC A03/MF A01 - GPO. File Number TI86003376.

From 13. water reactor safety research information meeting; Gaithersburg, MD, USA (22 Oct 1985).

This paper presents the latest results of the program entitled, "Probability Based Load Combinations For Design of Category I Structures". In FY 85, a probability-based reliability analysis method has been developed to evaluate safety of shear wall structures. The shear walls are analyzed using stick models with beam elements and may be subjected to dead load, live load and in-plane eqrthquake. Both shear and flexure limit states are defined analytically. The limit state probabilities can be evaluated on the basis of these limit states. Utilizing the reliability analysis method mentioned above, load combinations for the design of shear wall structures have been established. The proposed design criteria are in the load and resistance factor design (LRFD) format. In this study, the resistance factors for shear and flexure and load factors for dead and live loads are preassigned, while the load factor for SSE is determined for a specified target limit state probability of 1.0×10^{-6} or 1.0×10^{-5} during a lifetime of 40 years. 23 refs., 9 tabs.

11226 (EPRI-NP—4346) Utility machinery vibration monitoring guide (Interim). Moore, T.I.; Vinson, J.W. (Radian Corp., Austin, TX (USA)). Dec 1985. 276p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920098.

This guide presents a methodology for developing machinery vibration monitoring programs specifically designed for application within the utility industry. Section I of the guide contains this methodology. It is designed to enhance the development of a monitoring program which can be expanded in areas of proven positive benefits. Section I evaluates all aspects of the monitoring program including Objectives and Goals, Information Type, Timing and Format, Data Analysis, Data Acquisition, Measurement and Transducer Selection, Planning Personnel and Organization, Program Instrumentation, Program Costs, Program Justification, and Implementation of a Monitoring Program. The methodology is then applied to two host utility plants. Section II contains the monitoring programs developed by two host utilities using this guide. The host utilities are Gulf States Utilities and Philadelphia Electric Company.

11227 (EUR—9677) Community's research and development programme on decommissioning of nuclear power plants. Fourth annual progress report (year 1983). (Commission of the European Communities, Luxembourg). 1985. 123p. Commission of the European Communities, Luxembourg.

This is the fourth progress report of the European Community's program. (1979-83) of research on decommissioning of nuclear power plants. It covers the year 1983 and follows the 1980, 1981 and 1982 reports (EUR 7440, EUR 8343, EUR 8962). The present report describes the further progress of research and contains a large amount of results. For a majority of the 51 research contracts composing the 1979-83 programme, work was completed by the end of 1983; the conclusions drawn from this work are in this report. The European Community's program deals with the following fields: long-term integrity of buildings and systems; decontamination for decommissioning purposes; dismantling techniques; treatment of specific wastes materials (steel, concrete and graphite); large transport containers for radioactive waste produced in the dismantling of nuclear power plants; estimation of the quantities of radioactive waste arising from the decommissioning of nuclear power plants in the Community; influence of nuclear power plant design features on decommissioning.

11228 (INIS-mf—10008, pp 121-126) Event tree and its application in analysis of nuclear power plant operating states. Stanicek, J.; Vopatril, M.; Cillik, I. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The design and classification of the tree of events are given and a brief description is presented of the quantitative and qualitative analysis of possible states in nuclear power units. The definition of quantitative and qualitative analysis is given.

11229 (NUREG/CR—2344) Summary of studies on methods for detecting, locating, and characterizing metallic loose parts in nuclear reactor coolant systems. Kryter, R.C.; Shahrokhi, F. (Oak Ridge National Lab., TN (USA)). Oct 1981. Contract AC05-84OR21400. 70p. (ORNL/TM—7967). NTIS, PC A04/MF A01 - GPO. File Number TI85015991.

The intent of this report is to summarize concisely the more salient findings of a 2.5 year study of methods for loose-part detection, location, and characterization carried out at the Oak Ridge National Laboratory (ORNL). The details of the methods employed and the results obtained have already been documented, so no attempt is made here to duplicate the source document in its entirety. Rather, the present aim is to summarize the key results and to emphasize their likely ramifications for loose-part monitoring programs (both planned and underway) at US commercial nuclear power reactors in a manner that will be easily understandable and usable by NRC reviewers in their day-to-day licensing work.

11230 (OEFZS—4323) Report 1984. Work of the Austrian Research Center Seibersdorf in 1984. Schwach, G.W. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Stabsabteilung Forschungsplanung und Technologieprognose). May 1985. 30p. (In German). (FO—33/85). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701211.

The report gives a detailed survey of the work carried out by the Austrian Research Center Seibersdorf in 1984. The working program comprises five main areas: energy and safety, materials research, isotope and radiation techniques, measuring techniques and information processing, environmental protection, health and food, industrial consulting. A special chapter describes the activities of the scientific-technical services. The report further contains lists of lectures held at universities by members of the Research Center, of students working for their theses or diplomas and of publications and patents issued.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 11265, 11292, 11293, 11295, 11296, 11297, 11298, 11301, 11305, 11306, 11308, 11325, 11326, 11329, 11333, 11336, 11337, 11339, 11341, 11342, 11343, 11344, 11345, 11348, 11350, 11351, 11352

11231 (CONF-8510173—40) BWR pipe crack and weld clad overlay studies. Shack, W.J.; Kassner, T.F.; Maiya, P.S.; Park, J.Y.; Ruther, W.E.; Rybicki, E.F. (Argonne National Lab., IL (USA); Rybicki (E.F.), Inc., Tulsa, OK (USA)). Oct 1985. Contract W-31-109-ENG-38. 26p. NTIS, PC A03/MF A01 - GPO. File Number TI86004032.

From 13. water reactor safety research information meeting; Gaithersburg, MD, USA (22 Oct 1985).

This paper presents results on (a) the influence of simulated BWR environments and temperature on the intergranular-stress-corrosion cracking (IGSCC) susceptibility of sensitized stainless steels (SS), (b) the stress-corrosion susceptibility of alternative piping materials, (c) analysis of field components to assess the effectiveness of in-service inspection techniques and the in-reactor performance of weld overlay repairs, and (d) finite-element analyses and experimental measurement of residual stresses in weldments with weld overlays. Fracture-mechanics crack-growth data are presented to confirm correlations between the critical corrosion potentials required to inhibit IGSCC and the level of impurities in the environment. Slow-strain-rate tests show that very low levels of impurities (25 ppb of sulfate) can produce suseptibility to transgranular-stress-corrosion cracking (TGSCC) in Type 316NG SS and that nitrogen levels is SS above 0.1 wt. % appear to increase susceptibility to TGSCC. Preliminary results on a German Type 347NG SS suggest that it is at least as resistant to TGSCC in impurity environments as Type 316NG SS. Measurements on overlay weldments removed from the Hatch-2 reactor confirm that compressive residual stresses are produced on the inner surface of the weldments by the overlay.

11232 (DOE/ET/34215—37) Fuel Performance Improvement Program. Progress report, April 1984-March 1985. Ewing, R.H.; Patterson, J.F.; Woods, K.N. (Exxon Nuclear Co., Inc., Richland, WA (USA)). 4 Dec 1985. Contract AC02-76ET34215. 85p. (XN-NF—85-41). NTIS (US Sales Only), PC A05/MF A01; 1; GPO Dep. File Number DE86004189.

Progress under the Fuel Performance Improvement Program (FPIP) is reported for the period of April 1984 through March 1985. The objectives of the FPIP are to develop commercially viable LWR fuel designs which are highly resistant to pellet-cladding interaction (PCI) failures and to demonstrate the satisfactory irradiation performance of the selected designs. Destructive examination of eleven FPIP rods previously ramped in the Studevik reactor was completed at EIR in Switzerland. A poolside fuel examination after four cycles of irradiation was conducted at the Big Rock Point Reactor, and data analysis was initiated. Nine segmented FPIP rodlets which had been irradiated in the Big Rock Point reactor were ramp tested in the Studsvik reactor. 49 figs., 14 tabs.

11233 (EGG-REQ—7074) Aging/Systems Interaction Study, Component Residual Lifetime Evaluation and Feasibility of Relicensing. Progress report, FY 1985. Close, J.A.; Jacobs, P.T.; Korth, G.E.; Mudlin, J.M.; Server, W.L.; Spaletta, H.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1985. Contract AC07-76ID01570. 116p. NTIS, PC A06/MF A01 - GPO. File Number TI86004147.

This report documents the work performed on four research tasks in Fiscal Year 1985 (FY-1985) which were part of the Aging/Systems Interaction Study, Component Residual Lifetime Evaluation and Feasibility of Relicensing Project. The technical and management/institutional objectives for the project are described, followed by a description of the results of each task. The work on Task 1 involved identifying and prioritizing new research activities for the Nuclear Regulatory Commission (NRC) Nuclear Plant Aging Research (NPAR) Program. A proposed methodology and plan for aging-system interaction studies was developed in Task 2. The description of Task 3 work comprises a summary of nuclear plant life extension activities in the US, the technical basis associated with the residual life of metallic materials and a proposed plan for research on residual life assessment. Task 4 describes the initial evaluation of selected Standard Review Plan (NUREG-0800) sections to investigate the feasibility of relicensing. 14 refs., 13 figs., 20 tabs.

11234 (NUREG/CR—4292) Comparative analysis of constitutive relations in TRAC-PF1 and RELAP5/MOD1. Rohatgi, U.S.; Jo, J.H.; Slovik, G.C. (Brookhaven National Lab., Upton, NY (USA)). Jun 1985. Contract AC02-76CH00016. 104p. (BNL-NUREG—51898). NTIS, PC A06/MF A01 - GPO. File Number TI86001821.

The purpose of this document is to describe the basic thermal hydraulic models and correlations that were used in the TRAC-PF1 (Version 7.0) and RELAP5/MOD1/CYCLE=14 codes. Concerted efforts have also been made to assess the models described in the code manuals and to compare them with their FORTRAN versions in the code. Some discrepancies between the documentation and the code, some errors in the models, and variety of constraints on the models were found and have been reported here. Furthermore, comments based on BNL experience with TRAC-PF1 and RELAP5/MOD1 assessment have been made wherever seemed necessary. The text contains many FORTRAN variables in order to help the readers who might be interested in modifying these codes. A table comparing the constitutive relationships in these two codes have also been presented. The report has been arranged in eight technical sections for each code describing the flow regime maps and the correlations for interfacial area density, interfacial mass and energy transfer, interfacial momentum transfer, wall heat transfer, wall friction, form losses and choking. In the last two chapters, a summary of the discrepancies between the codes and their manuals, comments on the models and a list of recommendations for each code have been presented.

11235 (NUREG/CR—4347) Emergency diesel generator operating experience, 1981-1983. Battle, R.E. (Oak Ridge National Lab., TN (USA)). Oct 1985. Contract AC05-84OR21400. 79p. (ORNL/TM—9739). NTIS, PC A05/MF A01 - GPO. File Number TI86002835.

The purpose of this report is to update the operating experience of emergency diesel generators in nuclear power plants. Previously, similar data for 1976 through 1980 were reported in NUREG/CR—2989, "Reliability of Emergency AC Power Systems at Nuclear Power Plants." The two data sets are used to show trends of diesel generator performance, and responses by nuclear plant licensees to a nuclear regulatory questionnaire is included for additional data and comparison with the Licensee Event Report (LER) data collected for this report. 9 refs., 9 tabs.

11236 (NUREG/CR—4367) ORVIRT.PC: a 2-D finite-element fracture analysis program for a microcomputer. Bryson, J.W. (Oak Ridge National Lab., TN (USA)). Oct 1985. Contract AC05-84OR21400. 55p. (ORNL—6208). NTIS, PC A05/MF A01 - GPO. File Number TI86001867.

ORVIRT.PC (Oak Ridge VIRTual crack extension. Personal Computer) is a two-dimensional (2-D) finite-element fracture analysis program for an IBM PC/AT or PC/XT microcomputer. The code is based primarily on the techniques used in the ORMGEN-ADINA-ORVIRT fracture analysis system. ORVIRT.PC is a stand-alone program capable of performing 2-D linear-elastic stress and fracture-mechanics analyses. Thermal loadings may be analyzed in addition to mechanical loadings. Crack-face tractions may also be considered. Eight-noded isoparametric elements that combine both performance and ease of modeling are employed in the program. Special crack-tip elements that allow for an inverse square root variation in the near tip stress and strain fields may be used at the crack tip. Detailed user instructions describe both preparation of input data and program operation. Sample problems are presented that demonstrate good agreement with known solutions. 14 refs., 12 figs.

11237 **(PNL-SA—8757) Use of fuel-thermocouple scram response for data verification.** Lanning, D.D.; Cunningham, M.E. (Pacific Northwest Labs., Richland, WA (USA)). 30 Jun 1980. Contract AC06-76RL01830. 7p. (CONF-801107—c9). NTIS, PC A02/MF A01 - GPO. File Number TI85016696.

From ANS international conference; Washington, DC, USA (17 Nov 1980).

This report is concerned with the use of fuel-thermocouple scram response for data verification. The scrams discussed here are order-of-magnitude power decreases in less than one second. The transient response of fuel centerline thermocouples following scram is used to verify observed variations of fuel temperatures at fixed power, both among rods and for a given rod at different burnups. (JDB)

11238 **(PNL-SA—9938) Trends in thermal calculations for light water reactor fuel (1971-1981).** Lanning, D.D.; Cunningham, M.E. (Pacific Northwest Labs., Richland, WA (USA)). Oct 1981. Contract AC06-76RL01830. 18p. (CONF-811042—17). NTIS, PC A02/MF A01 - GPO. File Number TI85016716.

From 9. water reactor safety research information meeting; Washington, DC, USA (26 Oct 1981).

This paper will examine: the dramatic increase in the quantity, quality, and comprehensiveness of fuel temperature data; the reassessment of the partition of total thermal resistance between fuel and gap; and show the impact upon LOCA (loss-of-coolant accident) calculations due to reducing the input fuel stored energy. 18 refs., 10 figs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 11013, 11217, 11232, 11233, 11234, 11235, 11236, 11238, 11261, 11262, 11265, 11275, 11276, 11279, 11286, 11291, 11295, 11304, 11307, 11309, 11310, 11311, 11312, 11317, 11318, 11319, 11320, 11321, 11322, 11324, 11325, 11326, 11329, 11331, 11333, 11336, 11340, 11341, 11342, 11343, 11344, 11345, 11346, 11348, 11350, 11351, 11352, 11355, 11357, 11524, 11718

11239 **(EGG-EA—6422-Rev.1) Safety Evaluation Report, Pump and Valve Inservice Testing Program, Crystal River, Unit 3 (Docket No. 50-302). Revision 1.** Cook, T.L.; Rockhold, H.C. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1985. Contract AC07-76ID01570. 83p. NTIS, PC A05/MF A01 - GPO. File Number TI86005351.

This report presents the results of our evaluation of the Crystal River, Unit 3, Inservice Testing Program for safety-related pumps and valves.

11240 **(EGG/LTR—17-50) Stress analysis of the LOFT inspection fixture periscope and camera storage stand.** Finicle, D.P. (EG and G Idaho, Inc., Idaho Falls (USA)). 4 May 1977. Contract AC07-76ID01570. 14p. (EGG-RE-D—77-194). NTIS, PC A02. File Number DE85015851.

This report consists of the stress analysis of the LOFT inspection fixture periscope and camera storage stand. (JDB)

11241 **(EGG-PBS—6798) TMI-2 isotopic inventory calculations.** Schnitzler, B.G.; Briggs, J.B. (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1985. Contract AC07-76ID01570. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86004110.

Point isotopic depletion methods are used to develop spatially dependent fission product and heavy metal inventories for the TMI-2 core. Burnup data from 1239 fuel nodes (177 elements, 7 axial nodes per element) are utilized to preserve the core axial and radial power distributions. A full-core inventory is calculated utilizing 12 fuel groups (four burnup ranges for each of three initial enrichments). Calculated isotopic ratios are also presented as a function of burnup for selected nuclides. Specific applications of the isotopic ratio data include correlation of fuel debris samples with core location and estimates of fission product release fractions. 24 figs., 25 tabs.

11242 **(FRNC-CONF—218) Case of Three Mile Island.** Hennart, D. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium)). Dec 1984. 23p. (In French). (CONF-841281—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750331.

From SFEN meeting on decommissioning of facilities: balance and prospects; Paris, France (6 Dec 1984).

This paper describes the works undertaken on the reactor of TMI 2, which can be compared to dismantling operations. One successively depicts the actions carried out for managing the gas and waters produced during the accident and for the decontamination of walls, floors and materials. Then, the technical processes settled up for sifting and dismantling the reactor are described.

11243 **(INIS-mf—10008) Reliability of fossil-fuel and nuclear power installations.** (Ceskoslovenska Vedeckotechnicka Spolecnost, Prague. Dum Techniky). 1983. 278p. (In Czech, Slovak, German and Russian). (CONF-8310411—). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347.

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The conference heard a total of 37 papers of which 24 were input into INIS. The subject area was mainly the use of reliability information systems and the production of data banks for these systems, the application of the reliability theory and the reliability analysis of equipment and systems of nuclear power plants.

11244 (INIS-mf—10008, pp 16-25) **Optimization of reliability and quality of power sources in power systems.** Kaplun, S.M. 1983. (In Russian). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The complex problem is presented of optimizing the quality of power sources which includes indicators of reliability, manoeuvring ability, power reliability, etc. The series of reliability problems includes four sub-problems: the computation and optimization of structural reliability, the computation and optimization of standby production capacity loading, the optimization of repair cycles and time reserves and the probability estimate of the service life of individual parts of the facility. The first two computations were made for a nuclear power plants with WWER 1000 reactors. The optimization of the repair cycles and time reserves was made for a coal fired 800 MW power plant.

11245 (INIS-mf—10008, pp 175-180) **Steam turbines and reliability.** Drahy, J.; Randa, M. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

Monitoring of operating reliability is divided into three levels: the level of machines, the level of main assemblies, e.g., high pressure parts, the level of groups of parts. Diagrams represent the outage of turbines and the mean time between failures of 110 MW engines and 200 MW engines in dependence on time elapsed from complex trials. Experimental measurements were made under dynamic stress and increased pressure in the condenser and under abnormal mains frequencies. Limits of fatigue of the impeller blades were investigated. For investigating the service life of bodies samples are systematically taken after 40,000, 80,000 and 120,000 operating hours.

11246 (INIS-mf—10008, pp 204-208) **Life and reliability of water treatment equipment manufactured by CKD Dukla for fossil-fuel and nuclear power plants.** Kral, M. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The problems are discussed of the service life and reliability of operating assemblies for the treatment of make-up feed water, the treatment of turbine condensate in power plant units, the equipment for the treatment of supplementary and re-circulating cooling

water and thermal outgassing manufactured by CKD Dukla for high pressure power plant units of conventional and nuclear power plants. A survey is given of the frequency and causes of reported failures of delivered equipment between 1977 - 1982. The analysis of failure causes serves as the basis for introducing innovations and for R and D oriented to increasing reliability and extending the service life of manufactured equipment.

11247 (INIS-mf—10008, pp 209-213) **Monitoring and assessment of reliability of power installations in Vitkovice Concern.** Kuncicky, P.; Elbel, C.; Kawalec, M. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

In order to secure activities linked with monitoring, assessing and increasing the reliability of power facilities an information flow is being organized at VHJ Vitkovice incorporated in the information system for the reliability of power engineering. It determines the linkages between quality assurance, quality control, the commission for monitoring and assessing power facilities, specialist units, production enterprises and the management of the enterprise to secure that primary information on failures is analysed and that it should serve the implementation of corrective measures. Main attention is focused on the pressure system of boilers. Designs for the modification and complementation of the existing information system for nuclear power plant reliability are based on experience gained in this field.

11248 (INIS-mf—10008, pp 244-249) **Experience from monitoring reliability of V-1 nuclear power plant.** Dubrovcak, P. 1983. (In Slovak). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The Research Institute for Nuclear Power Plants at Jaslovske Bohunice is undertaking the project of the collection and assessment of data on the realiability of the nuclear power plant. The project proceeds from the reliability information system operated at conventional power plants and at the V-1 nuclear power plant. The principal demands are presented placed on the reliability information system and a brief summary given of the collected data. On the basis of knowledge obtained from the collection and assessment of reliability data at the V-1 nuclear power plant recommendations are made for the newly built reliability information system, mainly the need of extending the collection of data on maintenance, repairs, checks, failures and operating load.

11249 (INIS-mf—10008, pp 261-266) **Leak-proofness of sealed spaces - important aspect of reliable operation of nuclear power plants.** Balaz, P.; Csekey, L. 1983. (In Slovak). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

Local testing is carried out for sealing doors with and without manholes, assembly covers, pipe bushings, power bushing, control bushing and lining welds. A measurement desk was developed which tests the sealed spaces using liquid soap, the measurement of air flow into the control area and measurement of pressure decrease in the control area. An integral leak test is made immediately prior to the physical start-up of a nuclear power plant. All sealed spaces are linked in such a manner as to be pressurized with air. Pressure, mean temperatures and mean partial pressure of water vapor are recorded. A diagram is presented showing the measurement of the temperature of the atmosphere and the dewing point. Measurements are evaluated using the method of total time, the method of short intervals and the method of long-term intervals.

11250 (INIS-mf—10008, pp 36-41) **Information flow; a data bank preparation in nuclear power plant reliability information system.** Kolesa, K.; Vejvodova, I. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

In the year 1981 the reliability information system for nuclear power plants (ISS-JE) was established. The objective of the system is to make a statistical evaluation of the operation of nuclear power plants and to obtain information on the reliability of the equipment of nuclear power plants and the transmission of this information to manufacturers with the aim of inducing them to take corrective measures. The HP 1000 computer with the data base system IMAGE 100 is used which allows to process single queries and periodical outputs. The content of periodical outputs designed for various groups of subcontractors is briefly described and trends of the further development of the system indicated.

11251 (INIS-mf—10008, pp 47-51) **Experience from data acquisition for assessment of component life in V-1 nuclear power plant.** Hrazsky, M.; Mikus, M. 1983. (In Slovak). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The experience gained so far with the collection, recording and filing of data on temperature and pressure in the individual components of the primary and secondary circuits at different operating regimes is evaluated. The evaluation shows that for the computation of the service life of components of nuclear power plants it is necessary to put into operation an automated system for the collection, filing and evaluation of operating parameters. The needed range of data and conditions for the implementation of automated collection are given.

11252 (INIS-mf—10008, pp 127-134) **Reliability analysis of operating indicators of nuclear power plants.** Skvarka, P.; Kremnican, M. 1983. (In Slovak). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The results are given of the statistical analysis of indicators - the coefficients of availability obtained by the method of regression analysis. The basic methodological instrument was the regression of data by the increasing number of years from the start of commercial operation. Also monitored was the effect of the serial number of the unit on the site of the nuclear power plant on its reliability. The dependence was monitored of the coefficient of availability on the reactor manufacturer. A high dependence of the coefficient of availability was observed on the performance of the unit and on the reactor manufacturer. The time course over a period of 15 - 20 years of the availability coefficient was parabolic.

11253 (INIS-mf—10008, pp 142-146) **Computer-aided reliability analysis of complex systems.** Babic, P. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The methods are described of mathematical modelling of reliability elements and systems of nuclear power plants considering two states (operation and failure) and considering the renewability of the operation capacity of elements. The LOTR program was written for mathematical modelling. Inputs are either failure trees or reliability block diagrams.

11254 (LA—10288-PR, pp 61-62) **SOURCES calculation of TMI-2 spontaneous-fission and (α,n) neutron sources.** Wilson, W.B.; England, T.R.; Hopkins, W.C.; Perry, R.T. (Bechtel Power Corp., San Francisco, CA). Jan 1985. NTIS, PC A05/MF A01. File Number DE85010331.

In Applied nuclear science research and development. Semiannual progress report, October 1, 1983-May 31, 1984.

The SF and (α,n) neutron sources of TMI-2 were produced from full-core actinide inventories calculated with CINDER-2 using a library of ENDF/B-V data and following a 22-step histogram power history resolved for earlier TMI-2 fuel calculations. These actinide inventories were used in SOURCES calculations describing the neutron production from the SF decay of actinides and (α,n) reactions of their decay alphas with /sup 10,11/B and /sup 17,18/O. The (α,n) calculations used $\sigma(\alpha,n)$ data for /sup 17,18/O

as resolved from measured data and for /sup NAT/B as measured by Walker; polynomial fits to the data of Ziegler were used to describe alpha-particle stopping cross sections of the various elements. The neutron sources were calculated for the undisturbed, clad TMI-2 oxide fuel and for the extreme limiting condition in which each alpha particle is emitted into the boron-rich water. The results of these calculations, show that the TMI-2 neutron source from actinide decay could be increased by no more than a factor of ~ 5 by complete dispersion of actinides in the boron-rich water.

11255 **(PNL-SA—9585) Organohalogens in chlorinated cooling waters discharged from nuclear power stations.** Bean, R.M.; Mann, D.C.; Neitzel, D.A. (Pacific Northwest Labs., Richland, WA (USA)). Oct 1981. Contract AC06-76RL01830. 14p. (CONF-811068—3). NTIS, PC A02/MF A01 - GPO. File Number TI85016715.

From 4. conference on water chlorination: environmental impact and health effects; Pacific Grove, CA, USA (18 Oct 1981).

The objective of the present work is to extend our investigations to a study of organohalogen formation during biocide treatment of cooling water facilities at nuclear power stations, using the same methods we previously used to study the chlorination of natural waters. In addition, we wanted to extend our investigations to include a more detailed study of the halogenated phenols produced during chlorination.

11256 **(PNL-SA—13419) Surry steam generator - examination and evaluation.** Clark, R.A.; Doctor, P.G.; Ferris, R.H. (Pacific Northwest Labs., Richland, WA (USA)). Oct 1985. Contract AC06-76RL01830. 23p. (CONF-8510173—37). NTIS, PC A02/MF A01 - GPO. File Number TI86004025.

From 13. water reactor safety research information meeting; Gaithersburg, MD, USA (22 Oct 1985).

This report summarizes research conducted during the fourth year of the five year Steam Generator Group Project. During this period the project conducted numerous nondestructive examination (NDE) round robin inspections of the original Surry 2A steam generator. They included data acquisition/analysis and analysis-only round robins using multifrequency bobbin coil eddy current tests. In addition, the generator was nondestructively examined by alternate or advanced techniques including ultrasonics, optical fiber, profilometry and special eddy current instrumentation. The round robin interpretation data were compared. To validate the NDE results and for tube integrity testing, a selection of tubing samples, determined to be representative of the generator, was designated for removal. Initial sample removals from the generator included three sections of tube sheet, two sections of support plate and encompassed tubes, and a number of straight and U-bend tubing sections. Metallographic examination of these sections was initiated. Details of significant results are presented in the following paper. 13 figs.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 11300

11257 **(GA-A—17180) Small modular HTGR nuclear power plant concept to meet the total energy needs of the developing nations.** McDonald, C.F. (GA Technologies, Inc., San Diego, CA (USA)). 26 Sep 1983. 19p. (CONF-830905—13). GA Technologies, Box 85608, San Diego, CA 92138. File Number TI86900356.

From Joint power generation conference; Indianapolis, IN, USA (25 Sep 1983).

In this paper, a small modular High-Temperature Gas-Cooled Reactor (HTGR) is described that can support the total energy needs of the developing nations by supplying electrical power, process steam, low-grade heat for desalination, and hydrogen production. Major features of the nuclear power plant concept, currently under development by GA Technologies Inc. (GA), are discussed with emphasis on (1) plant simplicity, (2) inherent safety, (3) ease of operation, (4) design and licensing standardization, and (5) acceptable power generation economics.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 11922

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 10985, 11260, 11265, 11277, 11299, 11315, 11333, 11358

11258 **(EUR—9548) Advanced-fuel performance model Euges-Aries. Description and listing of the computer program and introduction to its use.** Ronchi, C.; van de Laar, J. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements; Commission of the European Communities, Luxembourg). 1984. 174p. Commission of the European Communities, Karlsruhe, Germany, F.R. European Inst. for Transuranium Elements.

FORTRAN 77.

The paper contains a brief description of the model for fission gas behavior and swelling in advanced LMFBR fuels (mixed carbide, particularly) which has been developed at Joint Research Centre of the European Communities in Karlsruhe. The model is based on mechanistic hypotheses on gas bubble formation and is therefore able to provide a detailed picture of the relevant macro- and microstructural modifications produced by swelling. An introduction to the computer program EUGES-ARIES, constructed to perform fuel performance calculations with this model, is given with thorough instructions for use. A listing of the program is attached.

11259 **Heat flux limiting sleeves.** Harris, W. G. (to The United States of America as represented by the United States Department of Energy, Washington, DC). US Patent 4,537,249. 27 Aug 1985. Filed date 2 Feb 1981. vp.

PAT-APPL-230554.

A heat limiting tubular sleeve extending over only a portion of a tube having a generally uniform outside diameter, the sleeve being open on both ends, having one end thereof larger in diameter than the other end thereof and having a wall thickness which decreases in the same direction as the diameter of the sleeve decreases so that the heat transfer through the sleeve and tube is less adjacent the large diameter end of the sleeve than adjacent the other end thereof.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 11257, 11316

11260 **(DOE/CL/02395—T9) Key points on proliferation and the LMFBR.** (Westinghouse Electric Corp., Madison, PA (USA)). 10 Mar 1977. Contract AC15-76CL02395. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85018259.

This paper provides historical background as well as current factors in the proliferation controversy associated with Liquid Metal Fast Breeder Reactors. (JDB)

11261 **(EGG-EA—6973) Conformance to Regulatory Guide 1.97, Catawba Nuclear Station, Unit Nos. 1 and 2 (Docket Nos. 50-413 and 50-414).** Stoffel, J.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1985. Contract AC07-76ID01570. 20p. NTIS, PC A02/MF A01 - GPO. File Number TI86005353.

This EG and G Idaho, Inc., report reviews the submittals for Regulatory Guide 1.97, Revision 2, for Unit Nos. 1 and 2 of the Catawba Nuclear Station and identifies areas of nonconformance to the regulatory guide. Exceptions to Regulatory Guide 1.97 are evaluated and those areas where sufficient basis for acceptability is not provided are identified.

11262 **(EGG-NTA—7112) Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, WNP, Unit Nos. 1 and 3 (Docket Nos. 50-460 and 50-508).** Haroldsen, R. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1985. Contract AC07-76ID01570. 8p. NTIS, PC A02/MF A01 - GPO. File Number TI86005352.

Generic Letter No. 83-28 included required actions based on the generic implications of the Salem ATWS events. This report documents the EG and G Idaho, Inc. review of the submittals from WNP Units 1 and 3 for conformance to Items 3.1.3 and 3.2.3 of Generic Letter 83-28.

11263 **(NUREG—0750-Vol.22-Index1) Indexes to Nuclear Regulatory Commission Issuances, July-September 1985. Volume 22, Index 1.** (Nuclear Regulatory Commission, Washington, DC (USA)). Dec 1985. 59p. NTIS, PC A04/MF A01 - GPO. File Number TI86900512.

Digests and indexes for issuances of the Commission (CLI), the Atomic Safety and Licensing Appeal Panel (ALAB), the Atomic Safety and Licensing Board Panel (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions of Rulemaking are presented in this document. These digests and indexes are intended to serve as a guide to the issuances. The period from July through September 1985 is covered.

11264 **(REG/G—5.62) Proposed Revision 1 to Regulatory Guide 5.62: reporting of physical security events. Draft regulatory guide and value/impact statement.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Oct 1985. 15p. US Nuclear Regulatory Commission, Washington, DC 20555. File Number TI86900215.

This regulatory guide provides an approach acceptable to the NRC staff for determining when and how an event should be reported. Examples are provided that represent the types of events that should be reported. These examples are not intended to be all-inclusive. (JDB)

2108 Economics

REFER ALSO TO CITATION(S) 11257, 11314

11265 **(DOE/SF/00893—T24) Breeder reactor economics.** Stauffer, T.R.; Palmer, R.S.; Wyckoff, H.L. (General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.; Harvard Univ., Cambridge, MA (USA); Commonwealth Edison Co., Chicago, IL (USA)). 1 Jul 1975. Contract AM03-76SF00893. 20p. (GE—003). NTIS, PC A02/MF A01; GPO Dep. File Number DE85018251.

This paper focuses on the comparative economics of fast breeder reactors versus light water reactors and develops an internally consistent set of financial techniques whereby a utility may determine and compare the costs of generating power with either system. The general methodology is used here to estimate the break-even capital costs for the breeder as a function of future uranium prices but is equally applicable to other reactor types. It is shown that by the time the breeder reactor (breeder) is commercially available, it is likely a utility would select a breeder even though its capital cost might be twice that of a light water reactor (LWR).

11266 **(NUREG/CR—4188-Vol.1) Nuclear power plant simulation facility evaluation methodology: handbook. Volume 1.** Laughery, K.R. Jr.; Carter, R.J.; Haas, P.M. (Oak Ridge National Lab., TN (USA)). Jan 1986. Contract AC05-84OR21400. 173p. (ORNL/TM—9570/V1). NTIS, PC A08/MF A01 - GPO. File Number TI86004940.

This report is Volume 1 of a two-part document which describes a project conducted to develop a methodology to evaluate the acceptability of nuclear power plant (NPP) simulation facilities for use in the simulator-based portion of NRC's operator licensing examination. The proposed methodology is to be utilized during two phases of the simulation facility life-cycle, initial simulator acceptance and recurrent analysis. The first phase is aimed at ensuring that the simulator provides an accurate representation of the reference NPP. There are two components of initial simulator evaluation: fidelity assessment and a direct determination of the simulation facility's adequacy for operator testing. The second phase is aimed at ensuring that the simulation facility continues to accurately represent the reference plant throughout the life of the simulator. Recurrent evaluation is comprised of three components: monitoring reference plant changes, monitoring the simulator's hardware, and examining the data from actual plant transients as they occur. Volume 1 is a set of guidelines which details the steps involved in the two life-cycle phases, presents an overview of the methodology and data collection requirements, and addresses the formation of the evaluation team and the preparation of the evaluation plan. 29 figs.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 12506

11267 **(CNEA-NT—14/83) Progress report 1981-1982. Reactor Chemistry Department.** (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Quimica de Reactores). Aug 1983. 351p. (In Spanish). NTIS (US Sales Only), PC A16/MF A01. File Number DE86700465.

Review is given of the activities performed by the Reactor Chemistry Department of the National Atomic Energy Commission of Argentina during 1981-1982. This Department provides services and assistance in all matters related to water chemistry and nuclear reactors chemistry, in all their phases: design, construction, commissioning and decommissioning. During this period, the following tasks were performed: study of the metallic oxide-water interphases; determination of the goethite and magnetite surficial charges; synthesis of the monodispersed nickel ferrites; study of the iron oxides dissolution mechanism in presence of different complexing agents; chemical decontamination of structural metals; thermodynamics of the water-nitrogen system; physico-chemical studies of aqueous solutions at high temperatures; hydrothermal decomposition of ionic exchange resins and study of the equilibria of the anionic exchange for the chemistry of pressurized reactor's primary loops. The appendix includes information on the Reactor Chemistry Department staff, its publications, services, seminars, courses and conferences performed during 1981-1982.

11268 **(CONF-8508105—6) Introduction to panel on "Where do we go from here".** Thomas, J.T. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86001357.

From DOE subcritical reactivity measurements workshop; Albuquerque, NM, USA (26 Aug 1985).

This report gives a brief description of the potential applications of a reliable method for measuring subcritical reactivities. (JDB)

11269 **(LA—10288-PR, pp 65-69) Core neutronics code development and application.** LaBauve, R.J.; England, T.R.; George, D.C.; MacFarlane, R.E.; Wilson, W.B. Jan 1985. NTIS, PC A05/MF A01. File Number DE85010331.

In Applied nuclear science research and development. Semiannual progress report, October 1, 1983-May 31, 1984.

The authors have completed a coupled Nuclear Data, Neutronics/Depletion Code System (DANDE) for neutronics calculations, and this system is now being used by the Los Alamos National Laboratory reactor design group in their reactor design calculations. A general layout of the code system is shown. The authors approach has been to link existing, proven codes through the use of a local controller (CTL) and to transfer files via a standard interface system.

11270 **(PNL-SA—13120) On-line acoustic emission monitoring of nuclear reactor systems: status and future.** Hutton, P.H. (Pacific Northwest Labs., Richland, WA (USA)). Jul 1985. Contract AC06-76RL01830. 4p. (CONF-8510159—2). NTIS, PC A02/MF A01 - GPO. File Number TI86004024.

From 2. international conference on acoustic emission; Lake Tahoe, NV, USA (28 Oct 1985).

This report dealing with on-line acoustic emission monitoring of nuclear reactor systems is concerned with the following topics: instrumentation; flaw detection; noise interference; AE signal identification; and AE data interpretation. (JDB)

2202 Components And Accessories

REFER ALSO TO CITATION(S) 11226, 11332, 11521, 11525, 11526

11271 (INIS-mf—10008, pp 188-203) **Design problems of reliable turbogenerators 2.** Glebov, I.A.; Loginov, S.I.; Bykov, V.M. 1983. (In Russian). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The possibilities are analysed of increasing the reliability of turbogenerators of various types and power - ranging from 63 to 800 MW. The effect on reliability is discussed of cooling, heat insulation, rotor material, stator, winding, and the connection of the different parts of the turbogenerator. A brief analysis is given of the physical causes of the damage of structural materials and a comparison is given with experimental data.

11272 (INIS-mf—10008, pp 214-219) **Reliability of power plant supply pumps and special valves.** Polach, J. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

Experience is presented gained with the use of data relating to the failure rate of feed pumps for 200 MW power units aimed at increasing their reliability such as is implemented within the reliability information system operated at the Sigma works. A complex indicator has been introduced for assessing reliability, namely the coefficient of availability. Also discussed are methods of securing the reliability of special valves for primary circuits of nuclear power plants during production and assembly.

11273 **(NUREG/CR—4302-Vol.1) Aging and service wear of check valves used in engineered safety-feature systems of nuclear power plants. Volume 1. Operating experience and failure identification.** Greenstreet, W.L.; Murphy, G.A.; Gallaher, R.B.; Eissenberg, D.M. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 73p. (ORNL—6193-Vol.1). NTIS, PC A04/MF A01 - GPO. File Number TI86003618.

This is the first in a series of three reports on check valves (CVs) to be published under the Nuclear Plant Aging Research Program, and it addresses the subject of Detection of Defects and Degradation Monitoring of Nuclear Plant Safety Equipment. The program is concerned with the evaluation and identification of practical and cost-effective methods for detecting, monitoring, and assessing the severity of time-dependent degradation (aging and service wear) of CVs in nuclear plants. These methods will allow degradation trends to be established prior to failure and allow guidance for effective maintenance to be developed. The topics of interest for this first report are failure modes and causes resulting from aging and service wear, manufacturer-recommended maintenance and surveillance practices, and measurable parameters (including functional indicators) for use in assessing operational readiness, establishing degradation trends, and detecting incipient failure. The results presented are based on information derived from operating experience records, nuclear industry reports, manufacturer-supplied information, and input from plant operators. Failure modes are identified for CVs. For each failure mode, failure causes are listed by subcomponent or subassembly, and parameters potentially useful for detecting degradation, which could lead to failure, are tabulated.

11274 **(NE-F—8-6T-Rev.(11-85)) Hoisting and rigging of critical components and related equipment. Revision.** (Oak Ridge National Lab., TN (USA)). 13 Dec 1985. Contract AC05-84OR21400. 78p. Performance Assurance Project Office-ORNL, Box Y, Oak Ridge, TN 37831. File Number TI86003829.

This standard covers hoisting and rigging of critical items (3.2) and of materials, components, or supplies handled over, in, or around spaces in which critical items are located. The purpose of this standard is to provide requirements and rules that will minimize the likelihood of physical damage to critical items due to dropping, upset, impact, or other handling accident.

2203 Fuel Elements

11275 **(CEA-CONF—7344) "CAMERA" test facility in the OSIRIS reactor. Diametral measurement device under flux of PWR fuel pins.** Bauge, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1984. 12p. (In French). (CONF-8409287—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750329.

From 28. irradiation devices working group meeting; Brasimone, Italy (12 Sep 1984).

CAMERA is an irradiation installation conceived to measure under neutronic flux and continuously the dimension variations of a fuel pencil of PWR reactors. The device, set in the periphery of the OSIRIS reactor, can receive new, preirradiated or reconstituted pencils. The principles of measurements is explained. Then, a brief description of the installation is given: in-pile part; out-of-pile part; connections. The technical characteristics of the installation are presented. A first qualification test of the installation under flux has been carried out at the end of the first semester 1984 in the OSIRIS reactor.

2204 Control Systems

11276 (INIS-mf—10008, pp 267-278) **Guidelines for reliability analysis of control elements and systems of nuclear power plants.** Hollo, E.; Czako, S.; Csiszar, A. 1983. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The relationship is analysed between operating failures and the control system reliability. The procedure is defined of the reliability analysis of the control system for nuclear power plants from the qualitative and quantitative points of view. The preparation of input failure data for computations is assessed. Reliability computations for nuclear power plants in the Hungarian People's Republic are still in the initial stage.

11277 **Potential safety enhancements to nuclear plant control: Proof testing at EBR-II.** Lindsay, R.W.; Chisholm, G.H.; Stratton, R.C. (Argonne National Lab., Idaho Falls, ID). pp 627-630 of Proceedings of the American power conference, vol. 46. Armington, R.E. Chicago, IL; Illinois Inst. of Technology (Apr 1984). (CONF-840412—).

From American power conference; Chicago, IL, USA (24 Apr 1984).

Future changes in nuclear plant control and protective systems will reflect an evolutionary improvement through increased use of computers coupled with a better integration of man and machine. Before improvements can be accepted into the licensed commercial plant environment, significant testing must be accomplished to answer safety questions and to prove the worth of new ideas. The Experimental Breeder Reactor-II (EBR-II) is being used as a test-bed for both inhouse development and testing for others in a DOE sponsored Man-Machine Integration program. The ultimate result of the development and testing would be a control system for which safety credit could be taken in the licensing process.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 11354, 11359, 11922, 12506

11278 (INIS-mf—9626-Vol.2, pp 179-183) **Monitoring of airborne radioactivity at Austrian and Hungarian nuclear training reactors.** Viragh, E. (Techn. Univ., Budapest (Hungary). Nuclear Training Reactor); Tschirf, E. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1984. NTIS (US Sales Only), PC A13/MF A01. File Number DE85781217. (CONF-830995—Vol.2).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

Taking into account that both nuclear reactors are situated in the inner town of capital the monitoring of released airborne radioactivity is one of the most important routine work of radiation protection. In the lecture the following topics will be discussed: 1. Basic physical aspects/developing of ^{16}N, ^{41}Ar, ^{14}C and radioactive fission products. 2. Basic radiation safety criteria in Austria and in Hungary. 3. Survey of applied measuring and monitoring techniques for airborne radioactivity. 4. Critical review of experiences.

11279 (INIS-mf—9626-Vol.2, pp 216-220) **Dose level measurements during startup of the first unit of the PAKS nuclear power plant.** Feher, S.; Nagy, M.F.; Viragh, E. (Techn. Univ., Budapest, (Hungary) Training Nuclear Reactor); Ronaky, J.; Rosa, G. (Paks Nuclear Power Plant, Paks (Hungary). Dept. for Radiation Protection). 1984. NTIS (US Sales Only), PC A13/MF A01. File Number DE85781217. (CONF-830995—Vol.2).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

An important part of measurements during startup of the Nuclear Power Plant concerned the determination of 'dose-map' in the controlled area. An investigation program was performed for obtaining gamma and neutron dose levels and the calculations with data were carried out by using a computer code PAVDAP. In this lecture we summarized our work as follows: a) experiences with the gamma and neutron dosimetric equipment (including calibration processes), b) the 'DAP' concept ('DAP' means Dosimetric Base Point'), c) the PAVDAP computer code, d) detailed analysis of results. The results presented indicate that shielding walls satisfy the design criteria and the dose level values fairly agree with the signs of the stationary installed radiation monitoring system ('SEIVAL').

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 11229, 11240, 11278, 11302

11280 (CONF-851021—1) **Thermal conductivities of U_3Si and U_3Si_2-Al dispersion fuels.** Williams, R.K.; Graves, R.S.; Domagala, R.F.; Wiencek, T.C. (Oak Ridge National Lab., TN (USA); Argonne National Lab., IL (USA)). 1985. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004796.

From 19. international thermal conductivity conference; Cookeville, TN, USA (20 Oct 1985).

Two high density uranium silicides are being evaluated as replacements for the research reactor fuels currently in use. Employing these compounds permits a major reduction in uranium enrichment, and tests have shown that the silicide fuels perform well under irradiation. Thermal conductivity data are required for analysis of these results and for safety calculations. The data show that silicide-Al dispersion fuels have somewhat better thermal conductivities than U_3O_8-Al dispersions, but their principal advantage is in their increased uranium content. The differences between the thermal conductivities of U_3Si and U_3Si_2 dispersions are small, but the microstructure of the dispersion was found to have a major influence on thermal conductivity. This seems to be associated with the formation of planar porosity defects during the roll bonding process, and differences as large as a factor of four (59 vs. 14 W/m . K) were noted for the samples having equal U_3Si_2 contents (46 v/o).

11281 (DOE/ER/03409—T2) **Pennsylvania State University Breazeale Nuclear Reactor. Thirtieth annual progress report, July 1, 1984-June 30, 1985.** Levine, S.H.; Totenbier, R.E. (Pennsylvania State Univ., University Park (USA). Dept. of Nuclear Engineering). Aug 1985. Contract AC02-76ER03409. 66p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86002949.

This report is the thirtieth annual progress report of the Pennsylvania State University Breazeale Nuclear Reactor and covers such topics as: personnel; reactor facility; cobalt-60 facility; education and training; Radionuclear Application Laboratory; Low Level Radiation Monitoring Laboratory; and facility research utilization. (JDB)

11282 (DOE/ER/04014—15) **University of Florida training reactor. Annual progress report, September 1, 1984-August 31, 1985.** Vernetson, W.G. (Florida Univ., Gainesville (USA). Dept. of Nuclear Engineering Sciences). Nov 1985. Contract AC05-76ER04014. 140p. (ORO—4014-15). NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86004469.

This annual progress report of the University of Florida Training Reactor discusses: reactor operation; personnel; modifications made to the reactors; reactor maintenance; and testing of reactor systems. (JDB)

11283 (EGG-EA—7116) **Ultra high flux reactor design: probing the limits of plate fuel technology.** Lake, J.A.; Parsons, D.K.; Liebenthal, J.L.; Ryskamp, J.M.; Fillmore, G.N.; deBoisblanc, D.R. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1985. Contract AC07-76ID01570. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005282.

This paper examined the capabilities and limitations of the plate fuel technology for producing unprecedented thermal neutron flux levels exceeding 10^{16} n/cm^2.s. The requirements for a flux configured over a large volume, and accessible to experimental instruments, as well as isotope production and materials irradiation access, dictates that the flux peak be generated external to the core and, most efficiently, in a large D_2O pool. A conventional thin cylindrical shell design appears to be limited to flux levels somewhat below goal values by plate temperatures and hydraulic conditions in the long, thin coolant channels, and to be life limited by cladding oxidation. A split or "double donut" core configuration with much shorter heated flow paths and a coolant mixing plenum between the upper and lower core sections, appears to be capable of enhanced thermal hydraulic performance, as well as improved neutronic access. It appears that evolutionary, rather than revolutionary, advances in plate-fuel technologies will indeed be capable of producing 10^{16} n/cm^2.s goal flux levels in a user friendly environment.

11284 (LA-UR—85-4176) **Rossi Alpha Method.** Hansen, G.E. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 6p. (CONF-8508105—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004725.

From DOE subcritical reactivity measurements workshop; Albuquerque, NM, USA (26 Aug 1985).

The Rossi Alpha Method has proved to be valuable for the determination of prompt neutron lifetimes in fissile assemblies having known reproduction numbers at or near delayed critical. This workshop report emphasizes the pioneering applications of the method by Dr. John D. Orndoff to fast-neutron critical assemblies at Los Alamos. The value of the method appears to disappear for subcritical systems where the Rossi-α is no longer an α-eigenvalue.

11285 (ORNL/TM—9862) **Oak Ridge Research Reactor quarterly report July, August, and September 1985.** Hamrick, T.P.; Ford, M.K. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004651.

The ORR operated at an average power level of 29.8 MW for 76.1% of the time during July, August, and September of 1985. The reactor was shut down on eight occasions, four of which were scheduled. Reactor downtime needed for refueling and checks was normal. The reactor remained available for operation 80.8% of the

time. Maintenance activities, both mechanical and instrument, were essentially routine in nature with the exception of one Instrumentation and Controls Change memorandum. In-service inspections completed during the quarter included inspections of primary heat exchangers Nos. 1, 2, 3, and 4 on August 16, 1985, plus the pool primary heat exchanger on August 13, 1985. 13 tabs.

2207 Plutonium And Isotope Production Reactors

11286 (CEA-CONF—7345) "OPERA" loop in the OSIRIS reactor core. Pressurized water irradiation device for the study of advanced reactor fuels. Lucot, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 18p. (In French). (CONF-8409287—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750330.

From 28. irradiation devices working group meeting; Brasimone, Italy (12 Sep 1984).

The OPERA loop will allow fuel qualification tests, i.e., irradiations of parts of assemblies sufficiently representative, operating in the nominal conditions of advanced reactors. After a presentation of the general design and of the main characteristics, a brief description of the loop is given: in-pile and out-of-pile part, and connections. The installation of the loop in the core of the OSIRIS reactor involves an adaptation of some components of this last one. Complementary installations will allow larger field of applications concerning the representativity of irradiation conditions and the knowledge of these conditions. The OPERA loop should be operating in 1987.

11287 (CONF-850610—35) Thermal reactor design for a neutron scattering source facility. Worley, B.A.; Difilippo, F.C.; Vondy, D.R. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016413.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

The purpose of this paper is to present conclusions drawn from preliminary neutronic calculations and to present a possible reactor design configuration capable of meeting the above thermal flux level, flux location, and lifetime requirements. (JDB)

11288 (ORNL/TM—1168/R2-Pt.2) Operating manual for the high flux isotope reactor. Operating procedures. Part 2. (Oak Ridge National Lab., TN (USA)). Jan 1986. Contract AC05-84OR21400. 288p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE86005340.

This volume covers: research facilities, cooling systems, containment (heating, ventilation, air conditioning), emergency equipment, waste systems, on-site utilities, records and data accumulation, auxiliary equipment, and technical specifications requirements and administrative operating policies. (DLC)

11289 (ORNL/TM—5711/R2) High Flux Isotope Reactor technical specifications. (Oak Ridge National Lab., TN (USA)). Nov 1985. Contract AC05-84OR21400. 70p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004653.

This report gives technical specifications for the High Flux Isotope Reactor (HFIR) on the following: safety limits and limiting safety system settings; limiting conditions for operation; surveillance requirements; design features; and administrative controls.

11290 (ORNL/TM—9880) High Flux Isotope Reactor quarterly report, July-September 1985. Corbett, B.L.; Farrar, M.B.; Belitz, K.S. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004597.

Three routine cycles of operation were completed during the third quarter. Eight scheduled shutdowns, however, resulted in an on-stream percentage of 70.5%. This low percentage on-stream time is attributed primarily to the replacement of the Cell 111 primary heat exchanger during the end-of-cycle-268 shutdown and the replacement of control plates, control cylinder, extension tubes, and shock-absorber tubes during the end-of-cycle-270 shutdown. Ten low-power (<90-MW) runs were performed during the quarter.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 11268, 11524, 11718, 11719, 11736, 11769, 12329

11291 (BNL-NUREG—36985) Review of the turbine-building flooding study of the Oconee PRA. Ilberg, D.; Hanan, N.A. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 5p. (CONF-860204—5). NTIS, PC A02/MF A01 - GPO. File Number TI86001170.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

A peer review of the Oconee Probabilistic Risk Assessment (OPRA) for Unit no. 3 was conducted at BNL for the NRC. This paper discusses the review of the OPRA turbine-building internal-flooding study, which is one of the dominant contributors, and was performed in great detail. This paper also includes a comparison with other flooding studies performed elsewhere. 5 refs., 1 tab.

11292 (BNL-NUREG—36986) Evaluation of ATWS core damage frequency for an earlier vintage BWR/4. Shiu, K.K.; Ilberg, D.; Hanan, N. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 5p. (CONF-860204—6). NTIS, PC A02/MF A01 - GPO. File Number TI86001190.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

In summary, this study evaluated the total core damage contribution due to ATWS events for an earlier vintage BWR/4. A realistic calculation was performed for a plant with a particular ATWS prevention and mitigation configuration and with some of the ATWS rule modifications implemented. Results are compared with the ATWS task force findings; three areas have been identified which could potentially have significant impact upon the ATWS core damage frequency contribution. 4 refs.

11293 (BNL-NUREG—36987) Containment performance evaluation for the GESSAR-II plant for seismic initiating events. Shiu, K.K.; Chu, T.; Ludewig, H.; Pratt, W.T. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 4p. (CONF-860204—1). NTIS, PC A02/MF A01 - GPO. File Number TI86000632.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

As a part of the overall effort undertaken by Brookhaven National Laboratory (BNL) to review the GESSAR-II probabilistic risk assessment, an independent containment performance evaluation was performed using the containment event tree approach. This evaluation focused principally on those accident sequences which are initiated by seismic events. This paper reports the findings of this study. 1 ref.

11294 (BNL-NUREG—36988) Comparison of methods applicable to evaluation of nuclear power plant technical specifications. Cho, N.Z.; Bozoki, G.E.; Youngblood, R.W. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 8p. (CONF-860204—8). NTIS, PC A02/MF A01 - GPO. File Number TI86001171.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

The sample problem devised in this study is to calculate core damage frequencies for different allowed outage times (AOTs) from an accident sequence using the three methods: (1) static fault tree approach, (2) time-dependent unavailability analysis, and (3) Markov analysis. The results obtained in this study give useful insights and lend confidence to the conclusion that the static fault tree approach can be used by NRC for the AOT problem when the quantified higher level measures, e.g., core damage frequency and health risks, turn out to be unequivocally below the criteria (e.g., the safety goals). However, when the higher level measures corresponding to the proposed AOTs are in the range of the criteria, the Markov analysis or the time-dependent unavailability analysis would be attractive to owners of the plants who bear the burden of proof in AOT relaxation. 7 refs., 2 figs.

11295 **(BNL-NUREG—36989) Liquid jet breakup characterization with application to melt-water mixing.** Ginsberg, T. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 6p. (CONF-860204—4). NTIS, PC A02/MF A01 - GPO. File Number TI86001189.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

Severe accidents in light-water reactors could lead to the flow of molten core material from the initial core region of the reactor vessel to the lower plenum. Steam explosions have been predicted to occur as a result of the contact of the melt with water available in the plenum. It is presently judged by many workers, that the magnitude of the energy released during such an in-vessel explosion would be insufficient to lead to failure of the containment building (SERG, 1985). A major contributing factor in this judgment is that the mass of melt which would participate in the interaction would be limited by the quantity of melt delivered to the lower plenum to the time of the explosion and by the limited breakup of the molten pour stream as it flows through the plenum prior to the explosion. Limited pour stream breakup would lead to limited melt-water mixing and, in addition, to the existence of "large-scale" melt masses which may lead to very inefficient thermal-to-mechanical energy conversion. The objective of this paper is to assess the available literature relevant to liquid jet breakup and to assess its implications with respect to the behavior of molten corium pour streams as they would flow from the core region through the lower plenum. Uncertainties in application of the available literature are discussed. 7 refs., 2 figs.

11296 **(BNL-NUREG—37004) Analysis of hydrogen production during a BWR6 core heatup transient.** Yang, J.W.; Pratt, W.T. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 8p. (CONF-860204—2). NTIS, PC A02/MF A01 - GPO. File Number TI86001200.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

An extensive study was performed for the prediction of hydrogen production during a BWR6 core heatup transient. Hydrogen production was found to be strongly affected by the transient core heat transfer and vessel hydrodynamics. Various sources important for steam generation and hydrogen production were identified. The results of the study were used by the NRC staff in their evaluation of the adequacy of the H_2 release histories suggested by the Hydrogen Control Owner's Group (HCOG). The owners group are sponsoring a 1/4 scale test program to investigate the adequacy of H_2 control during a degraded event. 1 ref., 2 figs.

11297 **(BNL-NUREG—37005) Mechanistic determination of fission product releases for a Mark III BWR plant.** Ludewig, H.; Yu, W.S.; Jaung, R.; Pratt, W.T. (Brookhaven National Lab., Upton, NY (USA)). 1986. Contract AC02-76CH00016. 8p. (CONF-860204—7). NTIS, PC A02/MF A01 - GPO. File Number TI86001199.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

During the review of the GESSAR-II PRA by the Nuclear Regulatory Commission (NRC) and their contractors at Brookhaven National Laboratory (BNL) it was necessary to reanalyze potential fission product releases to the environment for several core meltdown accident sequences. The reanalysis was performed at BNL in two stages. The first stage was carried out prior to detailed mechanistic models were available at BNL and consisted of a sensitivity analysis using the MARCH and CORRAL computer codes. The effects of uncertainties in primary system retention, suppression pool scrubbing and core/concrete interactions on fission product release were handled by varying inputs to the MARCH/CORRAL codes. In this paper we outline the second stage of fission product release calculations, which was based on a system of codes developed under sponsorship of the Accident Source Term Program Office (ASTPO), USNRC. A comparison will be made between the range of source terms calculated by the first approach and the point estimate calculations provided by the more mechanistic codes. 8 refs., 2 tabs.

11298 **(BNL-NUREG—37324) RAMONA-3B application to Browns Ferry ATWS.** Slovik, G.C.; Neymotin, L.Y.; Saha, P. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 21p. (CONF-8510173—43). NTIS, PC A02/MF A01 - GPO. File Number TI86004357.

From 13. water reactor safety research information meeting; Gaithersburg, MD, USA (22 Oct 1985).

The Anticipated Transient Without Scram (ATWS) is known to be a dominant accident sequence for possible core melt in a Boiling Water Reactor (BWR). A recent Probabilistic Risk Assessment (PRA) analysis for the Browns Ferry nuclear power plant indicates that ATWS is the second most dominant transient for core melt in BWR/4 with Mark I containment. The most dominant sequence being the failure of long term decay heat removal function of the Residual Heat Removal (RHR) system. Of all the various ATWS scenarios, the Main Steam Isolation Valve (MSIV) closure ATWS sequence was chosen for present analysis because of its relatively high frequency of occurrence and its challenge to the residual heat removal system and containment integrity. The objective of this paper is to discuss four MSIV closure ATWS calculations using the RAMONA-3B code. The paper is a summary of a report being prepared for the USNRC Severe Accident Sequence Analysis (SASA) program which should be referred to for details. 10 refs., 20 figs., 3 tabs.

11299 **(CONF-851115—42) EBR-II Shutdown Heat Removal Testing Program results and plans.** Planchon, H.P.; Golden, G.H.; Betten, P.R.; Chang, L.K.; Feldman, E.E.; Mohr, D. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004065.

From American Nuclear Society winter meeting; San Francisco, CA, USA (10 Nov 1985).

This report is concerned with the capability of LMR's to passively remove decay heat (via natural connection) and to passively shut down (without scram) for a loss of flow or loss of heat sink accident. (JDB)

11300 **(CONF-851201—8) Ultimate Safe (US) Reactor.** Gat, U.; Daugherty, S.R. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004798.

From 7. Miami international conference on alternative energy sources; Miami Beach, FL, USA (9 Dec 1985).

The Ultimate Safe (US) Reactor is a reactor that eliminates the traditional safety concerns of nuclear fission reactors. The US reactor has an insignificant source term and no reasonable criticality accident. Furthermore, the negligible residual after-heat in the reactor renders its shutdown capability comparable or superior to conventional power sources. Fission products are continuously removed at the rate they are produced. The reactor is operated with no excess criticality, hence no criticality accident is reasonably possible. The reactor is controlled safely by its negative temperature coeffiient. The reactor maintains criticality by an internal breeding ratio that is trimmed to be exactly one. The US reactor requires a fluid fuel and on-line, continuous fuel processing. Molten salt fuel was selected for its low vapor pressure at high temperature; adequate solubility of uranium and thorium as fluorides; good compatibility with structural materials; absence of irradiation damage; high negative temperature coefficient and amply developed technology and experience.

11301 **(CONF-8510173—36) MELRPI - development and use.** Sozer, A. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01 - GPO. File Number TI86003804.

From 13. water reactor safety research information meeting; Gaithersburg, MD, USA (22 Oct 1985).

The MELRPI computer code has been developed by Rensselaer Polytechnic Institute under the sponsorship of Oak Ridge National Laboratory (ORNL) and, more recently, the Empire State Electrical Energy Research Corporation (ESEERCO). The code was developed especially for severe accident analyses concerning BWRs and is not applicable to PWRs. MELRPI.MOD2, one of the ORNL-severe accident analysis codes, has been applied for the first

time to station blackout transient analysis for the Browns Ferry nuclear power plant in order to estimate the progression of core degradation.

11302 **(EGG-M—18485) Modeling a TRIGA Power System with ATHENA.** Davis, C.B. (Idaho National Engineering Lab., Idaho Falls (USA)). [1985]. Contract AC07-76ID01570. 9p. (CONF-860204—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004120.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

GA Technologies TRIGA Power System (TPS) is a power-producing version of the Training Research and Isotope General Atomic (TRIGA) reactor. The TPS analyzed here is designed to produce 10 MW of electrical power. The TPS features three major thermal-hydraulic systems, including a water-filled primary coolant system, a water-filled residual heat removal system, and a Freon-filled secondary coolant system. A thermal-hydraulic model of the TPS was developed using the Advanced Thermal Hydraulic Energy Network Analyzer (ATHENA) computer code, and two demonstration calculations were performed. ATHENA is based on the Reactor Excursion and Leak Analysis Program (RELAP5/MOD2) and has similar, but expanded capabilities. The expanded capabilities allow the representation of several different fluids, including water and Freon-11. This paper provides descriptions of the TPS, the ATHENA computer code and ATHENA TPS model, results of the demonstration calculations, conclusions, and references. 2 refs., 7 figs.

11303 **(EGG-M—24585) Analytical and experimental comparisons of modal properties of a flood water storage tank.** Thinnes, G.L.; Dooley, W.T.; Gorman, V.W. (Idaho National Engineering Lab., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 7p. (CONF-860224—5). NTIS, PC A02/MF A01 - GPO. File Number TI86003231.

From 4. international modal analysis conference, Los Angeles, CA, USA (3 Feb 1986).

Comparisons of measured frequencies, mode shapes, and damping from experimental modal testing and analytical predictions have been performed on a vertically standing 90,000 liter flood water storage tank. The purpose of the study was to compare the accuracy of analytical calculations with experimentally obtained data. The need for this comparison arises because safety assessments of the integrity of such vessels are normally based upon analyses which have not usually been validated by experiments. The tank was excited using random input from an electromagnetic shaker. Data reduction was performed using frequency response functions. Analyses, including modal analysis calculations, were performed on the tank for three water level conditions using finite element methods. Results of the analyses are presented, comparisons to test data are shown, and conclusions and recommendations are made as a result of these studies. 5 refs., 8 figs., 2 tabs.

11304 **(EGG-M—27785) Passive surveillance: a technique to characterize the condition of power and control circuits in a nuclear plant.** Meininger, R.D.; Dinsel, M.R. (Idaho National Engineering Lab., Idaho Falls (USA)). 1985. Contract AC07-76ID01570. 6p. (CONF-851009—34). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004153.

From IEEE nuclear science symposium; San Francisco, CA, USA (23 Oct 1985).

This paper reports on progress by EG and G Idaho in examination of electrical circuits exposed to the accident environment at Three Mile Island Unit 2 (TMI-2) during and after the loss-of-coolant accident of March 28, 1979. Interpretations of the data collected suggest that the major functional impact on the electrical circuits (a) occurs very late in time, (b) is caused by moisture intrusion, and (c) can be detected by remote surveillance prior to functional failure. The electrical testing was performed from outside the TMI-2 Reactor Building at the penetrations using a special circuit characterization and diagnostic system developed by EG and G Idaho. This paper concentrates on representative data from those circuits which were recently retested. 12 refs., 9 figs.

11305 **(EGG-NTA—7065) Audit of the environmental qualification of safety-related electrical equipment at the Hope Creek Generating Station (Docket No. 50-354).** Beahm, D.M.; Fehringer, J.M. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1985. Contract AC07-76ID01570. 40p. NTIS, PC A03/MF A01 - GPO. File Number TI86003256.

Hope Creek Generating Station, (HCGS), was audited to determine the environmental qualification of safety-related electrical equipment. Results of the audit are summarized in this report.

11306 **(EGG-NTA—7088) Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, Hope Creek Generating Station (Docket No. 50-354).** Haroldsen, R. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1985. Contract AC07-76ID01570. 8p. NTIS, PC A02/MF A01 - GPO. File Number TI86004122.

This EG & G Idaho, Inc., report provides a review of the submittals from Hope Creek Unit 1, for conformance to Generic Letter 83-28, items 3.1.3 and 3.2.3.

11307 **(EGG-NTA—7094) Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, Seabrook Units 1 and 2 (Docket Nos. 50-443 and 50-444).** Haroldsen, R. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1985. Contract AC07-76ID01570. 8p. NTIS, PC A02/MF A01 - GPO. File Number TI86004131.

This EG & G Idaho, Inc., report provides a review of the submittals from Seabrook Units 1 and 2, for conformance to Generic Letter 83-28, items 3.1.3 and 3.2.3.

11308 **(EGG-NTA—7097) Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, River Bend, Unit 1.** Haroldsen, R. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1985. Contract AC07-76ID01570. 8p. NTIS, PC A02/MF A01 - GPO. File Number TI86004130.

This EG and G Idaho, Inc., report provides a review of the submittals from River Bend Unit 1, for conformance to Generic Letter 83-28, items 3.1.3 and 3.2.3.

11309 **(EGG-NTA—7099) Conformance to Generic Letter 83-28 Items 3.1.3 and 3.2.3, Shearon Harris Unit 1 (Docket No. 50-400).** Haroldsen, R. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1985. Contract AC07-76ID01570. 8p. NTIS, PC A02/MF A01 - GPO. File Number TI86004121.

This EG & G Idaho, Inc., report provides a review of the submittals from Shearon Harris Unit 1 for conformance to Generic Letter 83-28, items 3.1.3 and 3.2.3.

11310 **(EGG-RTH—7064) Pretest analysis document for Test S-NH-1.** Owca, W.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1985. Contract AC07-76ID01570. 30p. NTIS, PC A03/MF A01 - GPO. File Number TI86004143.

This report documents the pretest analysis calculation completed with the RELAP5/MOD2/CY3601 code for Semiscale MOD-2C Test S-NH-1. The test will simulate the shear of a small diameter penetration of a cold leg, equivalent to 0.5% of the cold leg flow area. The high pressure injection system is assumed to be inoperative throughout the transient. The recovery procedure consists of latching open both steam generator ADV's while feeding with auxiliary feedwater, and accumulator operation. Recovery will be initiated upon a peak cladding temperature of 811 K (1000°F). The test will be terminated when primary pressure has been reduced to the low pressure injection system setpoint of 1.38 MPa (200 psia). The calculated results indicate that the test objectives can be achieved and the proposed test scenario poses no threat to personnel or to plant integrity. 12 figs.

11311 **(EGG-RTH—7066) RELAP5 thermal-hydraulic analyses of two pressurized thermal shock sequences for the Oconee-1 pressurized water reactor.** Bolander, M.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1985. Contract AC07-76ID01570. 84p. NTIS, PC A05/MF A01 - GPO. File Number TI86003255.

Thermal-hydraulic analyses of two pressurized thermal shock sequences for the Oconee-1 pressurized water reactor were

performed at the Idaho National Engineering Laboratory using the RELAP5/MOD2 computer code. This report presents the results of these calculations.

11312 **(EPRI-NP—4307) Modeling of reflux condensation and countercurrent annular flow in a two-phase closed thermosyphon.** Reed, J.G.; Tien, C.L. (California Univ., Berkeley (USA). Dept. of Mechanical Engineering). Dec 1985. 87p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920095.

Reflux condensation in the steam generator tubes of a PWR is a potentially important heat removal mechanism during the cooldown phase following a small-break LOCA. This work studies reflux condensation using the two-phase closed thermosyphon as a model system. An analytical model based on control-volume formulations of mass, momentum, and energy balances for the liquid and vapor flows in each section of the device is developed. Numerical solutions to the system of governing equations are presented for both steady-state and transient operation of the device. While no data with which to compare the results of the transient analysis are currently available, the steady-state solutions compare well with available experimental data on flooding and film thickness. Thus, the analytical approach presented in this work is demonstrated to be a powerful technique for analyzing countercurrent, annular, two-phase flows. 17 refs., 17 figs.

11313 **(EPRI-NP—4317) Risk-based evaluation of technical specifications.** Wagner, D.P.; Vesely, W.E.; Minton, L.A. (Battelle Columbus Labs., OH (USA)). Dec 1985. 174p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920096.

This report contains the results of EPRI Research Project 2142, Risk-Based Evaluation of Technical Specifications. This Project is one of EPRI's efforts to apply probabilistic risk assessment (PRA) techniques to solve utility problems. The Research Project was directed toward three main goals: develop a theory for risk-based analysis of technical specifications; develop a computer program to implement the theory; and perform case studies to verify the methodology, transfer the technology to utility participants, and provide examples of realistic evaluations.

11314 **(EPRI-NP—4350) Human engineering design guidelines for maintainability. Final report.** Pack, R.W.; Seminara, J.L.; Shewbridge, E.G.; Gonzalez, W.R. (General Physics Corp., Atlanta, GA (USA)). Dec 1985. 739p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920093.

This document provides guidance for systematically incorporating appropriate human factors techniques for maintainability into the design of power plants. Besides being used in the design of future plants, the guide can also be used to conduct maintainability reviews operating plants. It presents guidelines for the design of plants facilities, systems, and components, and it addresses the analytic techniques, the data, and the program planning to be used in the design process.

11315 **(HEDL-SA—3348-FP) TS-1 and TS-2 transient overpower tests on FFTF fuel.** Pitner, A.L.; Ferrell, P.C.; Culley, G.E.; Weber, E.T. (Hanford Engineering Development Lab., Richland, WA (USA)). 3 Oct 1985. Contract AC06-76FF02170. 19p. (CONF-851115—43). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004015.

From American Nuclear Society winter meeting; San Francisco, CA, USA (10 Nov 1985).

The TS-1 and TS-2 TREAT transient experiments subjected a low burnup (2 MWd/kg) and a medium burnup (58 MWd/kg), respectively, FFTF irradiated fuel pin to unprotected 5 cents/s overpower transient conditions. The fuel pin failure response was similar in the two tests, which demonstrated a large margin to failure ($P/P_0 > 3$) and a favorable upper level failure location. Thus, for these transient conditions, burnup effects on transient performance appeared to be minimal in the range tested. Pin disruption in the medium burnup TS-2 test was more severe due to the higher fission gas pressurization, but failure occurred at only a 5% lower power level than for the low burnup TS-1 fuel pin. Both tests exhibited axial extrusion of molten fuel to the region above the fuel column several seconds before pin failure, demonstrating a potentially beneficial inherent safety mechanism to delay failure and mitigate accident consequences.

11316 (INIS-mf—10008, pp 66-93) **Role of experts in the safety and reliability of nuclear installations. Analysis of situation in the Federal Republic of Germany.** Danzmann, H. 1983. (In German). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The role of experts in the licencing construction and surveillance of nuclear power plant operation in the FRG is described. The time needed for the assessment of the construction of nuclear power plants Philippsburg I, Isar I and Unterweser was 130 - 190 man-years per power plant. The demands placed on experts' qualifications and their in-service education are summed up. A group of experts carries out surveillance and thus contributes to the high level of reliability and safety of nuclear power plants in the FRG.

11317 (INIS-mf—10008, pp 135-141) **Monte Carlo simulation assessment of emergency core cooling system reliability of nuclear power plants.** Dusek, J. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

A reliability analysis was performed using the method of the failure tree and the SAFEDO-2 program. Reliability analysis consisted of the description of the system, the definition of the important functions, the construction of the failure tree and its quantification. The SAFEDO-2 program written in Fortran IV for the EC 1040 computer allows to evaluate the failure rate and non-readiness of systems considering periodical checks and the repairability of systems. Non-readiness was evaluated over 7000 hours of reactor operation and failure rate over 2 weeks. Variant computations assessed "weak" points of the project and assessed the effect of input data.

11318 (INIS-mf—10008, pp 154-159) **Statistical approach to safety assessment of WWER reactor pressure vessels.** Horacek, L.; Brumovsky, M.; Brynda, J. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The limit state of a pressure vessel is assessed which may be physically described as the plasticizing of a large area (in the order of m^2) of basic material - 15KH2MFA steel owing to quasistatic stress (internal overpressure) under normal operating conditions in the initial period of a WWER 440 reactor operation. The quantitative method was used of assessing the reliability of pressure vessel bodies, i.e., the so-called stress-strength overlap method. The basic principles are given of the method and some of the methodology problems encountered are described. An estimate was made of the probability of plasticizing in the neck area, of the smooth cylinder area and of the pole or the vessel eliptic bottom. The calculated estimates of probability are as follows: for the neck area 1.5×10^{-13}, for the cylinder area 1.1×10^{-10} and for the pole of the bottom 4.4×10^{-9}. The variability of stress and of the loading capacity of material was also determined.

11319 (INIS-mf—10008, pp 160-164) **Requirements for designing large district heating systems with respect to operating reliability.** Cillik, I. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The basic problems are briefly presented of the reliability analysis of nuclear power plants with heat extraction. The basic problem is to determine the relationship between stochastically set failure states and the deterministically determined heat supply in dependence on outages of subsystems and their effect on the operation of remaining facilities. The parameters of heating water and equipment should be selected such as to preclude the penetration of

activity into heat distribution systems in case of accident. The so-called failure tree will be constructed on the basis of the knowledge of operating conditions.

11320 (INIS-mf—10008, pp 250-254) **In-service monitoring of reliability of V-1 nuclear power plant equipment.** Kmosena, J.; Ondrejka, S. 1983. (In Slovak). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The method of monitoring and evaluating failures of equipment of the V-1 nuclear power plant followed up on the method of monitoring failures of equipment of the A-1 nuclear power plant and on rules issued for the power system in 1977. The method is defined in the works regulations of 1980. Monitoring was oriented to operating failures and defects, radiation accidents, violations of principles of nuclear safety and of reactor operating reliability, the principal recirculating pumps, steam generators, etc. The regulations are now being amended. Tables show power production losses owing to failures in the years 1979 to 1982.

11321 (INIS-mf—10008, pp 255-260) **Improving spray system reliability.** Pavlov, V.; Kalchev, B. 1983. (In Russian). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

The necessity has become evident of increasing the reliability of the current spray system for nuclear power plants with WWER 440 reactors. Four new schemes of sprinkler system are studied. It has been found that system reliability does not increase by increasing the level of standby pumps. When this standby system is linked with the standby accident tank the reliability of the system increases substantially. It will also increase by increasing the reliability of the accident tank and the control system. The range of the change depends on the level of system reserves. The optimal structure diagram of the spray system with increased reliability has been determined.

11322 (INIS-mf—10008, pp 42-46) **Information analysis and dissemination system of safety significant nuclear power plant failures.** Suchomel, J. 1983. (In Slovak). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

Similarly as in other countries with nuclear power plants Czechoslovakia is preparing a system of evaluation and distribution of information on failures of nuclear power plants. The tasks of the system including the exchange of reports within the Council of Mutual Economic Assistance and the IAEA are given as are examples of the analysis of failures of the Bohunice V-1 nuclear power plant.

11323 (INIS-mf—10008, pp 94-100) **Problems of applying the reliability theory in the nuclear power plant situation.** Cech, J. 1983. (In Czech). NTIS (US Sales Only), PC A13/MF A01. File Number DE86780347. (CONF-8310411—).

From Conference on reliability of fossil-fuel and nuclear power installations; Karlovy Vary, Czechoslovakia (25 Oct 1983).

Calculations of reliability indexes by valid standards proceed from the classical definition of reliability. In order to preclude incorrect results it is necessary to take into consideration the disjunction of individual failures as random phenomena. Demands placed on the calculation of reliability indexes may only exhaustively be fulfilled by a computation of conditioned probability of failures with an estimate of risk for unique products using the method of hypotheses testing.

11324 **(NUREG—1031-Suppl.4) Safety Evaluation Report related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423). Supplement No. 4.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1985. 231p. NTIS, PC A11/MF A01 - GPO. File Number TI86900417.

This report supplements the Safety Evaluation Report (NUREG-1031) issued in July 1984, Supplement 1 issued in March 1985, Supplement 2 issued in September 1985, and Supplement 3 issued in November 1985, by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission with respect to the application filed by Northeast Nuclear Energy Company (applicant and agent for the owners) for a license to operate Millstone Nuclear Power Station, Unit No. 3 (Docket 50-423). The facility is located in the Town of Waterford, New London County, Connecticut, on the north shore of Long Island Sound. This supplement provides more recent information supporting the license for initial criticality and power ascension to 5% power operation for Millstone 3. 37 refs., 10 tabs.

11325 **(NUREG—1079) Estimates of early containment loads from core melt accidents. Draft report for comment.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1985. 288p. NTIS, PC A13/MF A01 - GPO. File Number TI86900457.

The thermal-hydraulic processes and corium debris-material interactions that can result from core melting in a severe accident have been studied to evaluate the potential effect of such phenomena on containment integrity. Pressure and temperature loads associated with representative accident sequences have been estimated for the six various LWR containment types used within the United States. Summaries distilling the analyses are presented and an interpretation of the results provided. 13 refs., 68 figs., 39 tabs.

11326 **(NUREG/CR—1652) TRAC-P1A independent assessment, 1979.** Knight, T.D. (comp.). (Los Alamos Scientific Lab., NM (USA)). Jan 1981. Contract W-7405-ENG-36. 94p. (LA—8477-MS). NTIS, PC A05/MF A01 - GPO. File Number TI85015955.

This report presents the results of the TRAC-P1A independent assessment analyses performed during calendar year 1979. These calculations were performed with the publicly released version of the code and include separate-effects tests for vessel level swell and large-scale critical flow, integral-effects tests for the blowdown/refill/reflood phases of the large-break LOCAs, and integral-effects tests for small-break LOCAs. Although the independent assessment analyses do not represent an exhaustive study of the full range of available facilities and tests, they do represent a rigorous test of the capabilities of the code. The results indicate that the code is directly applicable to LOCA analyses; several areas have been identified for improvement in future code development. 25 refs., 79 figs.

11327 **(NUREG/CR—1977) Guidelines for preparing emergency procedures for nuclear power plants.** Morgenstern, M.H.; Clausen, M.J.; Foley, L.O.; Levy, G.W.; Myers, L.B.; Rankin, W.L.; Shikiar, R. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1981. Contract AC06-76RL01830. 36p. (PNL—3713). NTIS, PC A03/MF A01 - GPO. File Number TI86004938.

In response to the Three Mile Island (TMI) accident and the subsequent evaluation, the US Nuclear Regulatory Commission (NRC) has published the TMI Action Plan. This Action Plan identifies the need to provide Emergency Operating Procedures that treat the lower consequence/higher probability emergencies which had not been adressed in the past, and the need to incorporate good human factors practices in these procedures. The purpose of this document is to provide input to the NRC for use in developing guidelines for writing Emergency Operating Procedures for nuclear power plants. 3 figs.

11328 **(NUREG/CR—3634) Maintenance Personnel Performance Simulation (MAPPS) model. Users' Manual.** Kopstein, F.F.; Wolf, J.J. (Oak Ridge National Lab., TN (USA)). Sep 1985. Contract AC05-84OR21400. 108p. (ORNL/TM—9545). NTIS, PC A06/MF A01 - GPO. File Number TI86003557.

This report (MAPPS User's Manual) is the last report to be published from this program and provides detailed guidelines for utilization of the MAPPS model. Although the model has been developed to be highly user-friendly and provides interactive means

for controlling and running of the model, the user's manual is provided as a guide for the user in the event clarification or direction is required. The user will find that in general the model requires primarily user input that is self explanatory. Once initial familiarization with the model has been achieved by the user, the amount of interaction between the user's manual and the computer model will be minimal. It is suggested however that even the experienced user keep the user's manual handy for quick reference. 5 refs., 10 figs., 7 tabs.

11329 **(NUREG/CR—4103) Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety.** O'Brien, J.N.; Spettell, C.M. (Brookhaven National Lab., Upton, NY (USA)). Oct 1985. Contract AC02-76CH00016. 101p. (BNL-NUREG—51849). NTIS, PC A06/MF A01 - GPO. File Number TI86004006.

This report is the first in a series which documents research aimed at improving the usefulness of Probabilistic Risk Assessment (PRA) results in addressing human risk issues. This first report describes the results of an assessment of how well currently available PRA data addresses human risk issues of current concern to NRC. Findings indicate that PRA data could be far more useful in addressing human risk issues with modification of the development process and documentation structure of PRAs. In addition, information from non-PRA sources could be integrated with PRA data to address many other issues. 12 tabs.

11330 **(NUREG/CR—4171) TRAC-PF1/MOD1 independent assessment: LOBI large break transient A1-04R.** Kmetyk, L.N. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1985. Contract AC04-76DP00789. 131p. (SAND—85-0442). NTIS, PC E06/MF A01 - GPO. File Number TI86005239.

Includes 1 sheet of 48x reduction microfiche.

Results show that TRAC-PF1/MOD1 correctly predicts the major phenomena occurring during a large break accident. Subcooled and saturated discharge coefficients both equal to 1.0 give good agreement with data for break flows and primary system depressurization. Accumulator flow is calculated to begin within 1 s of the observed time, and the predicted accumulator injection is generally within 5% of the measured value. Both the peak clad temperature (788°K) and the overall rod temperatures are in acceptable agreement with data (823°K PCT). Sensitivity studies were done on the cold leg nodalization, the magnitude of the core bypass flow, the saturated break flow discharge coefficient and the accumulator surge line resistance. A coding error was discovered which resulted in the calculation of substantial and prolonged liquid superheat in the core; correcting this error did not, however, significantly change any of the global behavior calculated. These TRAC-PF1/MOD1 results are generally comparable to our previous RELAP5/MOD1 results for this same LOBI test. The input listing for the transient is included as microfiche.

11331 **(NUREG/CR—4189) TRAC-PF1/MOD 1 independent assessment: Semiscale MOD-2A feedwater-line break (S-SF-3) and steam-line break (S-SF-5) tests.** Dobranich, D. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1985. Contract AC04-76DP00789. 135p. (SAND—85-0576). NTIS, PC E06/MF A01 - GPO. File Number TI86004715.

Includes 1 sheet of 48x reduction microfiche.

The TRAC-PF1/MOD1 independent assessment project at Sandia is part of an overall effort funded by the NRC to determine the ability of various systems codes to predict the detailed thermal/hydraulic response of LWRs during accident and off-normal conditions. As part of this effort, calculations for Semiscale Mod-2A test S-SF-3, a feedwater-line break test, and S-SF-5, a steam-line break test, were performed with TRAC-PF1/MOD1. Most aspects of both the S-SF-3 and S-SF-5 steady-state calculations were found to be in good agreement with data. However, the need for a better steam separator model was identified from the S-SF-3 calculation. Overall, the qualitative behavior of both transients was calculated reasonably well; however, there were some discrepancies in the prediction of the quantitative behavior. The results for the S-SF-3 transient calculation indicate that the primary-to-secondary heat transfer degradation began too early. This was possibly due to overprediction of entrainment in the steam generator boiler, leading to an incorrect calculation of the secondary-side fluid distribution during the steady state. However, there was insufficient data to verify this. Results for the S-SF-5 transient calculation indicate that the primary-side fluid temperature response to a steam-line break was in reasonable agreement with data but the pressure response did not coincide with the data. Uncertainties in the data are sufficient to prevent us from determining the exact cause of this discrepancy, but there is indirect evidence that the calculated rate of phase change in the pressurizer was incorrect. 16 refs., 73 figs., 13 tabs.

11332 **(NUREG/CR—4329) Reliability evaluation of containments including soil-structure interaction.** Pires, J.; Hwang, H.; Reich, M. (Brookhaven National Lab., Upton, NY (USA)). Dec 1985. Contract AC02-76CH00016. 128p. (BNL-NUREG—51906). NTIS, PC A07/MF A01 - GPO. File Number TI86004934.

Soil-structure interaction effects on the reliability assessment of containment structures are examined. The probability-based method for reliability evaluation of nuclear structures developed at Brookhaven National Laboratory is extended to include soil-structure interaction effects. In this method, reliability of structures is expressed in terms of limit state probabilities. Furthermore, random vibration theory is utilized to calculate limit state probabilities under random seismic loads. Earthquake ground motion is modeled by a segment of a zero-mean, stationary, filtered Gaussian white noise random process, represented by its power spectrum. All possible seismic hazards at a site, represented by a hazard curve, are also included in the analysis. The soil-foundation system is represented by a rigid surface foundation on an elastic halfspace. Random and other uncertainties in the strength properties of the structure, in the stiffness and internal damping of the soil, are also included in the analysis. Finally, a realistic reinforced concrete containment is analyzed to demonstrate the application of the method. For this containment, the soil-structure interaction effects on; (1) limit state probabilities, (2) structural fragility curves, (3) floor response spectra with probabilistic content, and (4) correlation coefficients for total acceleration response at specified structural locations, are examined in detail. 25 refs., 21 figs., 12 tabs.

11333 **(NUREG/CR—4340-1) Reactor safety research semiannual report, January-June 1985. Volume 33.** (Sandia National Labs., Albuquerque, NM (USA)). Oct 1985. Contract AC04-76DP00789. 344p. (SAND—85-1606-1). NTIS, PC A15/MF A01 - GPO. File Number TI86004757.

This semiannual report on reactor safety research is concerned with the topics: containment loading and response; fission-product source term; LWR damaged fuel phenomenology; melt progression code development (MELPROG); advanced reactor accident energetics; and post-accident heat removal. 84 refs., 166 figs., 19 tabs. (JDB)

11334 **(NUREG/CR—4364) Management perceptions of the Health Physics Technician job.** Mazour, T.J.; Marotta, F.J. (Brookhaven National Lab., Upton, NY (USA)). Dec 1985. Contract AC02-76CH00016. 223p. (BNL-NUREG—51912). NTIS, PC A10/MF A01 - GPO. File Number TI86004031.

In 1984, an industry-wide job analysis of nuclear power reactor Health Physics Technicians (HPTs) was completed. These results provided the basis for job descriptions, industry-wide task listings and recommendations for task selections for further analysis and formal training. A total of 389 tasks were identified and reviewed by 850 HPTs representing 39 plants and 6 vendor companies. Constructive criticism of the HPT job analysis focused on the fact that HPT supervisors and managers were not included in the survey. Concerns were addressed that these supervisors/managers might have a divergent perception of the HPT job that could lead to different conclusions than those that were originally drawn. The only way to confirm (or deny) this hypothesis was to verify the results of the job analysis of HPTs by also surveying radiation protection management personnel. A total of 19 HPT supervisors/managers completed the same survey that had been used for HPT job incumbents. They were asked to rate each task on the basis of their job incumbents' performance of the task. Of the 1161 ratings (389

tasks each with a rating for frequency, difficulty, and importance), only 37 of the ratings differed between the HPTs and the HPT supervisors/managers (at the 99% confidence level).

11335 **(NUREG/CR—4378) Objective indicators of organizational performance at nuclear power plants.** Olson, J.; Osborn, R.N.; Jackson, D.H.; Shikiar, R. (Battelle Human Affairs Research Center, Seattle, WA (USA); Pacific Northwest Labs., Richland, WA (USA)). Jan 1986. Contract AC06-76RL01830. 53p. (PNL—5576; BHARC—400/85/013). NTIS, PC A04/MF A01 - GPO. File Number TI86005112.

This report summarizes research conducted on the development and validation of organizational performance measures at operating nuclear power plants. Publicly available data, including measures from Licensee Event Reports, operating and outage data, and violations data, are used to predict penultimate measures of plant safety. Penultimate measures of safety include potentially significant events, overexposures and near overexposures, and several radiological release measures. The 1981 and 1982 performance measures are used in correlation and regression analyses to predict performance on the penultimate safety measures in 1982 and 1983. Many of the plant performance measures are consistently predictive of the frequency of potentially significant events. No strong, consistent predictors emerge for exposures or liquid radiological releases. Several performance measures are consistent predictors of gaseous releases. The regression analyses indicate that the predictors do not tend to combine in consistent, multivariate patterns, and controls for plant age, size, type, region, and fuel cycle stage do not substantially affect the results. The analysis concludes that existing performance data do appear to be predictive of some aspects of plant safety performance. The report recommends that more reliable, summary performance measures be created by combining several of the performance measures tested in the current analysis.

11336 **(NUREG/CR—4400) Impact of mechanical- and maintenance-induced failures of main reactor coolant pump seals on plant safety.** Azarm, M.A.; Boccio, J.L.; Mitra, S. (Brookhaven National Lab., Upton, NY (USA); Impell Corp., Melville, NY (USA)). Dec 1985. Contract AC02-76CH00016. 99p. (BNL-NUREG—51928). NTIS, PC A05/MF A01 - GPO. File Number TI86004714.

This document presents an investigation of the safety impact resulting from mechanical- and maintenance-induced reactor coolant pump (RCP) seal failures in nuclear power plants. A data survey of the pump seal failures for existing nuclear power plants in the US from several available sources was performed. The annual frequency of pump seal failures in a nuclear power plant was estimated based on the concept of hazard rate and dependency evaluation. The conditional probability of various sizes of leak rates given seal failures was then evaluated. The safety impact of RCP seal failures, in terms of contribution to plant core-melt frequency, was also evaluated for three nuclear power plants. For leak rates below the normal makeup capacity and the impact of plant safety were discussed qualitatively, whereas for leak rates beyond the normal make up capacity, formal PRA methodologies were applied. 22 refs., 17 figs., 19 tabs.

11337 **(NUREG/CR—4428) Overview of TRAC-BD1/MOD1 assessment studies.** Charboneau, B.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1985. Contract AC07-76ID01570. 54p. (EGG—2422). NTIS, PC E04/MF $5.25 - GPO. File Number TI86004708.

Includes 9 sheets of 24x reduction microfiche.

This report summarizes a series of computer simulations sponsored by the United States Nuclear Regulatory Commission (USNRC) performed at the Idaho National Engineering Laboratory (INEL) to continue the advancement of boiling water reactor (BWR) safety research. The simulations were performed to evaluate the analysis capabilities of the Transient Reactor Analysis Code BWR version (TRAC-BD1/MOD1) to calculate operational transients, including anticipated transients without scram (ATWS) and loss-of-coolant accidents (LOCAs). The assessment simulations were performed for a broad range of scenarios, to encompass as many different phenomena as possible. Comparisons are made between the measured and calculated data. Conclusions are made with respect to the calculated system pressure response, thermal response, and break flow response, as well as the capabilities to model containment and natural circulation conditions. Recommendations are made with respect to user guidelines. 16 refs., 25 figs., 6 tabs.

11338 **(NUREG/CR—4431) Summary report on the Seismic Safety Margins Research Program.** Cummings, G.E. (Lawrence Livermore National Lab., CA (USA)). Jan 1986. Contract W-7405-ENG-48. 74p. (UCID—20549). NTIS, PC A04/MF A01 - GPO. File Number TI86004897.

The Seismic Safety Margins Research Program (SSMRP) was a program to develop a complete, fully coupled analysis procedure (including methods and computer codes) for estimating the risk of an earthquake-induced radioactive release from a commercial nuclear power plant. The SSMRP was the first effort to trace seismically induced failure modes in a reactor system down to the individual component level, and to take into account common-cause earthquake-induced failures at the component level. This report summarizes methods and results generated by SSMRP. The SSMRP method makes use of three computer codes, HAZARD, SMACS and SEISIM to calculate ground motion acceleration time histories, structure and component responses and failure, and radioactive release probabilities. To demonstrate the methodology, an analysis was done of the Zion Nuclear Power Plant. The median frequency of core melt was computed to be 3E-5 per year, with upper (90%) and lower (10%) bounds of 8E-4 and 6E-7 per year. The main contribution to risk came from earthquakes about 2 through 4 times the design basis earthquake level. Risk was dominated by structural and inter-building piping failures and loss of offsite power. Sensitivity studies were undertaken to test assumptions and modeling procedures relative to soil-structure interaction effects, feed-and-bleed cooling, and structural failures. Assumptions made could have an order-of-magnitude effect on core melt frequency. Also, guidelines were developed for simplifying the SSMRP method, and importance rankings were generated based on the Zion analysis. 56 refs., 6 figs.

11339 **(PNL-SA—8261) Decommissioning a boiling water reactor nuclear power plant.** Oak, H.D.; Holter, G.M. (Pacific Northwest Labs., Richland, WA (USA)). Jan 1980. Contract AC06-76RL01830. 4p. (CONF-800607—85). NTIS, PC A02/MF A01 - GPO. File Number TI85016694.

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

This paper summarizes the results of a study sponsored by the US Nuclear Regulatory Commission to develop plans for and evaluate the costs and safety of conceptually decommissioning a reference boiling water reactor (BWR) nuclear power plant.

11340 **(PNL-SA—8477) Accident assessment: role of the containment radiation monitor.** Desrosiers, A.E.; Scherpelz, R.I.; Smith, M.S.; Grimes, B.K. (Pacific Northwest Labs., Richland, WA (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1980. Contract AC06-76RL01830. 25p. (IAEA-CN—39/95; CONF-801056—6). NTIS, PC A02/MF A01 - GPO. File Number TI85016693.

From International conference on current nuclear power plant safety issues; Stockholm, Sweden (26 Oct 1980).

The containment radiation monitor may provide information to a power reactor operator that can aid assessment of the degree of core damage following a loss-of-coolant accident (LOCA). This paper reports calculations of the exposure rates that would exist in the containment of a commercial pressurized water reactor (PWR) following severe reactor transients. The results indicate exposure rates of 1 to 2 R . h^{-1} 30 minutes after a large LOCA, 4 to 5 x 10 R . h^{-1} one hour following a release of the gap activity, and 4 . 10^6 R . h^{-1} two hours after a transient that resulted in a fuel melt. Furthermore, differences between the energy spectra of photons released by noble gases and halogens suggest that containment radiation monitors may be designed to differentiate between these radioelements. The calculated exposure rates are not in agreement with the response of containment radiation monitors during the incident at the Crystal River Reactor. Inhomogeneous source terms, the operation of containment building systems, and inaccuracies in

release estimates, measurements and calculations may have contributed to this discrepancy in one degree or another.

11341 **(PNL-SA—9985) Reliability of inservice ultrasonic flaw detection.** Becker, F.L. (Pacific Northwest Labs., Richland, WA (USA)). Oct 1981. Contract AC06-76RL01830. 15p. (CONF-811042—21). NTIS, PC A02/MF A01 - GPO. File Number TI85016706.

From 9. water reactor safety research information meeting; Washington, DC, USA (26 Oct 1981).

This report summarizes the third year's activities on a seven year program which is being conducted by PNL on behalf of the US Nuclear Regulatory Commission. The objectives of this program are: determine the reliability of ultrasonic inservice inspection performed on commercial, light water reactor pressure vessels and piping; using fracture mechanics analysis, determine the impact of NDE unreliability on system safety and determine the level of inspection reliability required to assure a suitably low failure probability; evaluate the degree of reliability improvement which could be achieved using improved and advanced NDE techniques; and based on material, service and NDE uncertainties, formulate recommended revisions to ASME section XI and regulatory requirements needed to assure suitably low failure probabilities. (JDB)

11342 **(PNL-SA—13318) Probabilistic risk assessments modeled on a micro-computer.** Powers, T.B. (Pacific Northwest Labs., Richland, WA (USA)). Jul 1985. Contract AC06-76RL01830. 6p. (CONF-851125—17). NTIS, PC A02/MF A01 - GPO. File Number TI86004022.

From American Society of Mechanical Engineers winter annual meeting; Miami, FL, USA (17 Nov 1985).

The Pacific Northwest Laboratory (PNL), is under contract to the US Nuclear Regulatory Commission (NRC) to provide technical assistance in the development of cost and risk estimates for prioritizing reactor safety issues. As part of this program, PNL has developed several micro-computer probabilistic risk assessment (PRA) programs. These programs are based on and modeled after existing PRA results. These micro-computer programs model the accident sequences and minimal cut sets as described in the PRA reports. The PRAs that have been modeled represent the following plants: Oconee-3, Grand Gulf-1, Calvert Cliffs-2, Millstone-1, and Arkansas Nuclear One-1. These programs are useful for evaluating the change in core-melt frequency or public risk base on changes in equipment, procedures, and operator actions. The advantages of these programs are speed of calculations, elimination of calculational error due to repetitious calculations, and hard copy Quality Assurance printout. These advantages allow for extensive use in performing sensitivity analyses.

11343 **(SAND—80-0544C) Qualification Testing Evaluation (QTE) program for safety-related equipment.** Bonzon, L.L.; Gillen, K.T.; Clough, R.L.; Salazar, E.A.; Buckalew, W.H.; Thome, F.V.; Stuetzer, O.M.; Feit, R. (Sandia National Labs., Albuquerque, NM (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1980. Contract AC04-76DP00789. 18p. (IAEA-CN—39/104; CONF-801056—4). NTIS, PC A02/MF A01 - GPO. File Number TI85016663.

From International conference on current nuclear power plant safety issues; Stockholm, Sweden (26 Oct 1980).

The nuclear power industry is required to demonstrate that certain safety-related equipment is "qualified" and will function even in the event of a severe reactor accident. Demonstration of qualification by testing is the preferred approach. International interest in equipment qualification, and its recognition as being paramount to safety, is rapidly increasing, with most major supplier-countries developing sophisticated qualification testing facilities. An aspect of the demonstration of qualification is to assure that the qualification testing applied to safety-related equipment is both realistic and conservative; that is, a program of qualification methodology assessment and improvement is imperative. In the United States, the Nuclear Regulatory Commission (NRC) is sponsoring the Qualification Testing Evaluation Program with the goal of obtaining data that will confirm or improve the technical bases for equipment qualification programs. This multi-task Program has long-term, continuing objectives, but recent new results have been obtained and these results are being incorporated into NRC regulations with attendant impact on the nuclear industry. 19 refs. (JDB)

11344 **(SAND—81-0123C) Two-dimensional empirical model for analyzing steam explosion experiments.** Corradini, M.L.; Mitchell, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 9p. (CONF-810606—9). NTIS, PC A02/MF A01 - GPO. File Number TI85016664.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

This paper describes an empirical explosion model, which is being used with a two-dimensional hydrodynamics computer code, CSQ, to analyze large-scale steam explosion experiments. (JDB)

11345 **(SAND—81-0158C) Probabilistic risk assessment of filtered-vented containment systems. Mark I BWR.** Benjamin, A.S.; Harper, F.T.; Cybulskis, P. (Sandia National Labs., Albuquerque, NM (USA); Battelle Columbus Labs., OH (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-810606—8). NTIS, PC A02/MF A01 - GPO. File Number TI85016666.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

This report is concerned with the probabilistic risk assessment of filtered-vented containment systems. (JDB)

11346 **(SAND—81-0655C) Core material redistribution accompanying accident sequences leading to degraded cores.** Rivard, J.B. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 33p. (CONF-810333—2). NTIS, PC A03/MF A01 - GPO. File Number TI85016713.

From Faculty institute on light water reactor safety-degraded core cooling; Argonne, IL, USA (16 Mar 1981).

This report describes the redistribution of core material in a pressurized water reactor (PWR) following accident sequences leading to degraded cores. 45 refs. (JDB)

11347 **(SAND—81-0947C) Value impact assessment of standard review plan sections.** Kolaczkowski, A.M.; Garcia, A.A.; Ferrell, W.L. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 9p. (CONF-810905—1). NTIS, PC A02/MF A01 - GPO. File Number TI85016712.

From ANS/ENS topical meeting on probabilistic risk assessment; Port Chester, NY, USA (20 Sep 1981).

This paper describes work performed for the US Nuclear Regulatory Commission (NRC) regarding the value, in terms of the potential for risk reduction, of certain Standard Review Plan (SRP) sections. These values are compared with the impact, in terms of NRC manpower expended, related to each SRP section. The study applies in a rather unique way, standard probabilistic risk assessment techniques to obtain a value impact assessment for the SRP sections. This work should aid the NRC in assessing the best use of limited manpower when reviewing safety analysis reports against the requirements of the SRP.

11348 **(SAND—81-1101C) Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels.** Corradini, M.L.; Mitchell, D.E.; Nelson, L.S. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1981. Contract AC04-76DP00789. 16p. (CONF-811101—5). NTIS, PC A02/MF A01 - GPO. File Number TI85016704.

From Winter annual meeting of the American Society of Mechanical Engineers; Washington, DC, USA (15 Nov 1981).

Current results are presented of steam explosion experiments and analysis using simulant molten reactor materials. For the single drop tests, we demonstrate that initial conditions can suppress the explosion at fixed trigger strength, but the explosion can be reinduced with a larger trigger. In large scale tests, we observe propagating explosions with shock pressures of 10 to 30 MPa and conversion ratios of 1 to 3%. Our analysis indicates that 1-D and 2-D models for the explosion can be used to predict some aspects of the explosion using a thermal fragmentation mechanism. 21 refs., 11 figs.

11349 **(SAND—85-1577C) Effects of reactor core-simulant aerosols on hydrogen/air combustion.** Nelson, L.S.; Benedick, W.B.; Einfeld, W.; Guay, K.P.; Valdez, G.D.; Lee, J.H.; Knystautas, R.; Fresko, M.; Gaug, M.;. (Sandia National Labs., Albuquerque, NM (USA); McGill Univ., Montreal, Quebec (Canada)). 1985. Contract AC04-76DP00789. 8p. (CONF-860204—14). NTIS, PC A02/MF A01 - GPO. File Number TI86004276.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

Three representative reactor core-simulant aerosols were dispersed, just before ignition, into combustible hydrogen-air mixtures contained in 5.1 and 0.18 m^3 chambers. Oxidic aerosols (Al_2O_3, Fe_2O_3) produced only minor changes in the burns. A metallic aerosol (Fe) ignited along with the hydrogen, producing more complete combustion of the hydrogen and substantially increased overpressures and thermal effects compared to control experiments performed identically without the aerosols. We attempted to use the rule of Le Chatelier to correlate flammability limits in the iron aerosol-hydrogen-air system determined in both experimental chambers. We showed that the rule does not apply well to hybrid mixtures such as these. We also showed that results obtained in small-scale apparatus may be misleading for metallic aerosols, where the flame thicknesses (~1 m) may be larger than the vessel dimensions. We recommend that large-scale apparatus be used whenever possible when studying lean flammability limits of either aerosols alone or hybrid aerosol-gas mixtures. 3 refs., 2 figs.

11350 **(SAND—85-1614C) Evaluation of the bases for estimating alpha-mode failure probabilities.** Berman, M. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 12p. (CONF-860204—10). NTIS, PC A02/MF A01 - GPO. File Number TI86003930.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

Much research has been devoted to understanding fuel-coolant interactions (FCIs) that might occur during core-melt accidents in water reactors. One major objective of this research is the evaluation of the probability of containment failure due to an in-vessel steam explosion (alpha-mode failure). Such a failure could conceivably contribute significantly to the risk associated with these accidents. Similarly, demonstrating that such a failure is extremely unlikely could significantly reduce the uncertainty concerning estimates of risk. Most analyses of alpha-mode failure decompose the failure into several stages, all of which are assumed to be necessary for containment failure to occur. The following is the description generally employed (throughout this paper, words in single quotes indicate qualitative terms which must eventually be quantified): A 'large' amount of melt accumulates in the core region, a 'large' fraction of which pours 'rapidly' into the lower plenum, which contains a 'large' quantity of water. The melt mixes 'efficiently' with the water to form a premixture. The premixture is 'triggered' and an 'energetic' explosion ensues which accelerates a water-fuel-structure 'slug' up the core barrel, creating a missile out of the upper head with a 'velocity' sufficient to propel it through the containment dome. Hypotheses and models have been developed which claim that one or more of these stages is impossible. This paper will examine the bases for those claims and the extent to which they agree with experimental observations and calculations, and with each other. 37 refs., 1 tab.

11351 **(SAND—85-1615C) Recent intermediate-scale experiments on fuel-coolant interactions in an open geometry (EXO-FITS).** Marshall, B.W. Jr.; Berman, M.; Krein, M.S. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-860204—11). NTIS, PC A02/MF A01 - GPO. File Number TI86003931.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

The Nuclear Regulatory Commission is sponsoring research on the interactions of molten core materials with water at Sandia National Laboratories. These interactions can play important roles during severe core-melt accidents. They can influence: the rates and total quantities of hydrogen and steam generated; the nature and timing of a hypothetical failure of the primary system and containment; debris characteristics and dispersal; and fission product characteristics. Over the last few years, experiments have been conducted at Sandia using ~5 to 20 kg of simulant melts dropped into various sized lucite water chambers. This paper discusses three series of experiments that address various aspects of fuel-coolant interactions (FCIs) which are important to reactor safety analyses; the Coarse Mixing (CM) series, the Oxide Melt (OM) series and the Alternate Contact Mode (ACM) series. These experiments were conducted in an open geometry (EXO-FITS) at an ambient pressure of 0.082 MPa. Two melt compositions (iron/alumina and iron-oxide) were prepared by means of thermitic reactions. Water temperatures ranged from ambient to about 366°K (saturated). The test series, number of tests and the primary FCI variables are listed. 13 refs., 2 figs., 3 tabs.

11352 **(SAND—85-1666C) MELPROG analysis of the DF-1 severe core damage experiment.** Smith, R.C.; Kelly, J.E. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-860204—15). NTIS, PC A02/MF A01 - GPO. File Number TI86004275.

From Thermal reactor safety meeting; San Diego, CA, USA (2 Feb 1986).

In this paper, some key features of MELPROG have been compared to the experimental data provided in the DF-1 test. The predicted thermal response of the fuel rods was consistent with the measured results. This result implies that the heat transfer, fluid flow, and oxidation power modelling in the code were correctly modelled. Since these processes govern the melting and relocation of the fuel rods, it is especially important that these be modelled correctly. Even though the measured amount of hydrogen could not be predicted, it is believed that the differences were most likely due to additional steam sources and not due to a poor oxidation model. When the rods were not steam starved, the predicted rate of hydrogen generation and, hence, oxidation was in good agreement with the data. Hence, the oxidation modelling in the code seemed to be adequate. However, further assessment of this modelling with more reliable data is warranted. During the debris relocation phase, MELPROG was in good qualitative agreement with the observed blockage formation. However, the model could not properly treat the fuel pellet remnants. Nevertheless, the model still reproduces some of the important observed features. More importantly, these comparisons have revealed important modelling deficiencies in the code that need to be addressed. Improvements in this area currently in progress. 3 refs., 1 fig., 1 tab.

11353 **(TPR-NS—25-No.4) Nuclear Safety, Volume 25, No. 4. Technical progress review, July-August 1984.** Silver, E.G. (ed.). (Oak Ridge National Lab., TN (USA)). Aug 1984. 172p. GPO $6.50. File Number TI84014483.

Individual papers were processed for the data bases.

11354 **(UCRL—84191) Concept of underground nuclear power plant siting for retaining post accident atmospheres.** Bowman, B.R.; Watling, H.E.; McCauley, E.W. (Lawrence Livermore National Lab., CA (USA)). Feb 1981. Contract W-7405-ENG-48. 25p. (CONF-810323—1). NTIS, PC A02/MF A01 - GPO. File Number TI85016668.

From Symposium in underground siting of nuclear power plants; Hannover, F.R. Germany (16 Mar 1981).

Preliminary design criteria developed for a general case show that underground siting of nuclear power reactors is practicable and safe. The concept calls for open-pit excavation in any geological medium to allow construction of the reactor containment structure. A desirable depth of excavation for the containment structure. A desirable depth of excavation for the containment building and steam generators is about 90 meters. After construction the pit is backfilled with selected earth material. The backfill is designed so that it will confine any radioactivity release that might result from a rupture of the containment structure within a small envelope. The additional cost of putting the nuclear portion of the system underground is only a small fraction of the cost of a conventional surface nuclear power plant. The turbine/generator sets must be located at or near the surface for minimum capital expenditures and operating cost. Underground reactor siting as proposed herein will apparently require no new technology. Closure methods and other relevant experience in the area of underground nuclear device testing are also discussed. 16 refs., 11 figs.

11355 **Aerosol generation by liquid breakup resulting from sparging of molten pools of corium by gases released during core/concrete interactions.** Ginsberg, T. (Brookhaven National Lab., Upton, NY). *Nuclear Science and Engineering;* **89**: 36-48(1985).

Aerosol release is expected from a pool of molten corium that is agitated by gases that would emerge from concrete during the core/concrete interactions phase of a core meltdown accident in a light water reactor. A corium flow-regime-dependent model is developed for aerosol generation by mechanical breakup of the melt by the flowing vapors. Previous work reported in the literature is used to identify the dominant corium gas/liquid flow regimes and to formulate the flow/regime transition criteria. Models are presented for the calculation of an aerosol entrainment rate under conditions of bubbly- and churn-turbulent, two-phase pool conditions.

11356 **Consideration of resource privation by severe reactor accidents.** McKone, T.E.; Griesmeyer, J.M.; Baldewicz, W.L. (Lawrence Livermore National Lab., CA). *Nuclear Safety;* **25**: No. 4, 472-481(Jul-Aug 1984).

Adverse impacts from a nuclear power-plant accident that threatens to or actually does release a large amount of radioactive material off site are manifested in several ways. Management of risks from nuclear power plants has generally been through regulations intended to prevent releases of radioactive material, through emergency planning, and through siting practice. Societal impacts that are not explicitly addressed under current emergency planning and siting practice include the costs of limiting radiation exposures, the disruption and loss to society associated with contamination, and the indirect health effects associated with decontaminations and radionuclide migration. This article considers some of these additional societal losses from nuclear accidents. An approach is outlined for determining whether (and, if so, what) additional measures might be taken for better management of potential societal resource losses. It is concluded that the potential for major losses of resources should be further investigated and ways to evaluate their significance should be developed.

11357 **(NUREG/TR—0053) Research program on mechanical and thermodynamic interactions between principal vapor flow and emergency water injection in a PWR reactor. Volume I. (Part I. EPIS I Experiment) Test Operations, 1975-1976.** Pochard, R. (Nuclear Regulatory Commission, Washington, DC (USA); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service d'Etudes Energetiques). Oct 1978. Translation of S.E. EN-RT.76.014, March 1976. 53p. NTIS, PC A04/MF A01 - GPO. File Number TI85901906.

This report is concerned with the EPIS I experiment, who's aim is to study the phenomena of dynamic interaction, in regard to injection, and their spatial evolution. The fluids chosen are air, to simulate superheated steam, and water. (JDB)

11358 **(RISLEY-Trans—4114) Fast reactor status review. Development work on core protective instrumentation.** Jacobi, S. Translated from *KFK-Nachrichten ;* **10**: No. 3-4, 109-115(1978). 18p. NTIS (US Sales Only), MF A01. File Number DE85902092.

This is a review on the development work on core protective instrumentation for LMFBR type reactors. This report covers topics such as: monitoring of the fuel element outlet temperatures; monitoring of the fuel element flow; integral methods for the detection of sodium boiling; nuclear techniques for the monitoring of fuel elements for cladding-tube damage; and irradiation experiments with components of the reactor instrumentation. (JDB)

11359 **(NUREG-tr—0015) Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976.** (Nuclear Regulatory Commission, Washington, DC (USA); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Nov 1977. Translation of IRS-F.31, September 1976. 387p. NTIS, PC A17/MF A01 - GPO. File Number TI85901904.

This report is concerned with the area of reactor safety. Topics covered include: malfunction and safety installations; malfunction sequences and safety installations; transient processes in the reactor core and in the primary circuit during the blowdown phase; transient processes in the nuclear reactor during the low-pressure phase; failure of combustible rods under the conditions of malfunction due to loss of coolant without melting of the housing; processing in containment during accidental coolant loss; core meltdown; characteristics and effects of a burst fusing; system analysis of the treatment of malfunction under consideration of technical safety regulations; environmental protection during cases of extreme malfunction; earthquakes; chemical explosions, aircraft crashes; improving operational safety; and quality assurance. (JDB)

25 ENERGY STORAGE

2503 Pumped Hydro

REFER ALSO TO CITATION(S) 11154

2506 Thermal

11360 **(CONF-851048—11) High temperature composite thermal storage systems for industrial applications.** Petri, R.J.; Ong, E.R.; Marianowski, L.G. (Institute of Gas Technology, Chicago, IL (USA)). 1985. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86003074.

From 168. meeting of the Electrochemical Society; Las Vegas, NV, USA (13 Oct 1985).

An advanced, thermal energy storage (TES) subsystem is being developed by the Institute of Gas Technology (IGT which employs composite phase change material (PCM)/sensible heat media (CompPhase). This medium/subsystem is amenable to high temperature thermal storage applications such as industrial reject/process heat recovery and utilization, off-peak utility, and solar thermal and solar dynamic space power systems. The CompPhase concept allows for direct contact heat exchange between the latent/sensible storage media and compatible working fluids. A number of potentially significant TES system performmance and cost advantages are thereby offered over conventional tube intensive indirect contact molten-salt latent-heat-based storage subsystems. Materials processing, stability analysis, modeling and development efforts are progressing on composite systems from 390 to 1750°F. Performance testing of a bench-scale packed-bed unit with ~50 lbs of pellets has accumulated over 6000 hours and 200 thermal cycles, with excellent media stability (~.3% weight loss in 1000 hours) and high heat transfer rates (~10,390 Btu/hr discharge heat removal rate). Preliminary economic assessments indicate that the projected cost for this advanced subsystem is below the maximum allowable cost for typical high temperature reject heat recovery applications, as well as being ~30% lower in cost than current baseline sensible-heat based TES systems.

2509 Batteries

REFER ALSO TO CITATION(S) 11494, 11701

11361 **(AD-A—157945/7/XAB) Lithium insertion in $V_3Nb_9O_{28}$. A Wadsley-Roth type phase. Technical report, June 1984-July 1985.** Wang, E.; Kimura, N.; Greenblatt, M. (Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Chemistry). Jul 1985. 4p. (TR—8). NTIS, PC A02/MF A01.

Compounds that can reversibly incorporate lithium atoms into their structure are of interest because of their potential use as cathode materials in secondary batteries. Recently Cava et al, reported on the lithium insertion reactions of Wadsley-Roth type phases. These compounds are oxide crystallographic shear structures that form with stoichiometries between MO_3 and MO_2. The structures can be described in terms of blocks of corner sharing MO_6 octachedra which are finite in two out of three dimensions, and are joined to adjacent blocks of edge sharing. Thus there are

nxmx infinity ReO_3-type units, where n and m are the length and width of the blocks. The structures display open-tunnel-like regions (which can accommodate small cations) bound by extensive MO_6 octahedra edge sharing. It is shown that some crystallographic shear is required to stabilize ReO_3-type structures upon lithium insertion. In summary, $V_3Nb_9O_{29}$ a Wadsley-Roth type phase, undergoes lithium insertion reversible to $Li^{13}{}^6V_3Nb_9O_{29}$ at room temperature and shows promise as a feasible electrode material for secondary lithium batteries.

11362 **(ANL/OEPM—85-4) Testing and development of electric vehicle batteries for EPRI Electric Transportation Program. Technical report for November 1982-December 1984.** (Argonne National Lab., IL (USA)). Nov 1985. Contract W-31-109-ENG-38. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86004178.

Argonne National Laboratory conducted an electric-vehicle battery testing and development program for the Electric Power Research Institute. As part of this program, eighteen battery modules previously developed by Johnson Controls, Inc. were tested. This type of battery (EV-2300 - an improved state-of-the-art lead-acid battery) was designed specifically for improved performance, range, and life in electric vehicles. In order to obtain necessary performance data, the batteries were tested under various duty cycles typical of normal service. This program, supported by the Electric Power Research Institute, consisted of three tasks: determination of the effect of cycle life vs peak power and rest period, determination of the impact of charge method on cycle life, and evaluation of the EV-2300 battery system. Two supporting studies were also carried out: one on thermal management of electric-vehicle batteries and one on enhanced utilization of active material in lead-acid batteries.

11363 **(CONF-851146—2) Testing activities at the National Battery Test Laboratory.** Hornstra, F.; DeLuca, W.H.; Mulcahey, T.P. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004057.

From Annual battery and electrochemical energy storage contractors' meeting; Washington, DC, USA (18 Nov 1985).

The National Battery Test Laboratory (NBTL) is an Argonne National Laboratory facility for testing, evaluating, and studying advanced electric storage batteries. The facility tests batteries developed under Department of Energy programs and from private industry. These include batteries intended for future electric vehicle (EV) propulsion, electric utility load leveling (LL), and solar energy storage. Since becoming operational, the NBTL has evaluated well over 1400 cells (generally in the form of three- to six-cell modules, but up to 140-cell batteries) of various technologies. Performance characterization assessments are conducted under a series of charge/discharge cycles with constant current, constant power, peak power, and computer simulated dynamic load profile conditions. Flexible charging algorithms are provided to accommodate the specific needs of each battery under test. Special studies are conducted to explore and optimize charge procedures, to investigate the impact of unique load demands on battery performance, and to analyze the thermal management requirements of battery systems.

11364 **(CONF-851146—3) First international workshop on battery testing, 30 September-2 October 1985, Heidelberg, FRG. Summary report.** Hornstra, F. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004058.

From Annual battery and electrochemical energy storage contractors' meeting; Washington, DC, USA (18 Nov 1985).

In June 1984, after the last Contractors' Conference, representatives from several countries met in Washington, DC to discuss international cooperation in advanced battery research and development. Because of the diversity of approaches in various countries and the minimum attention in international forums for battery testing, the representatives agreed on the desirability of a workshop to discuss testing methodologies. As a result, the first International Workshop on Battery Testing was organized and held in Heidelberg, Germany from 30 September through 2 October 1985.

11365 **(CONF-851146—Summs.) Project summaries: seventh battery and electrochemical contractors' conference.** (Battelle Columbus Labs., OH (USA); Pacific Northwest Labs., Richland, WA (USA)). Nov 1985. Contract AC06-76RL01830. 128p. NTIS, PC A07/MF A01; GPO Dep. File Number DE86003020.

From Annual battery and electrochemical energy storage contractors' meeting; Washington, DC, USA (18 Nov 1985).

The overall goal of the United States' energy policy is to foster an adequate supply of energy at a reasonable cost. This policy recognizes that "adequate supply" requires flexibility in the energy system, with no reliance on any single source of supply. The Energy Storage Program of the Office of Energy Storage and Distribution is supporting this policy by providing the technology base and exploratory development required for the more effective use of electrochemical technologies, aimed at improved energy flexibility in transportation, electric utility, and industrial applications. This document represents a compilation of seventy-four project summaries of research supported by the US Department of Energy, Energy Storage Program. Sections included in this report are: Sodium Sulfur Research and Development, Flow Battery Research and Development, Advanced Battery Research, Systems Analysis, Performance and Testing, Metal Air Batteries, and Fuel Cells.

11366 **(CONF-851192—1) Electrode kinetic measurements of very fast reactions: metal deposition-dissolution in molten halides.** Nagy, Z.; Settle, J.L. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86003431.

From International workshop on high temperature molten salt batteries; Argonne, IL, USA (5 Nov 1985).

In an effort to reconcile the large discrepancies in the reported exchange current densities, an error analysis was carried out for the experimental measuring techniques used in their determinations. Dc relaxation techniques (potentiostatic or galvanostatic pulses) were chosen as the subject of this work. It was found that if the electrode system falls outside the field of applicability, because the surface reaction is fast compared to diffusion to and from the surface, the exchange current density measurement can display a systematic error.

11367 **(CONF-851192—2) Transport mechanisms in β-lithium/aluminum: an overview.** Susman, S.; Brun, T.O.; Volin, K.J. (Argonne National Lab., IL (USA)). Oct 1985. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004036.

From International workshop on high temperature molten salt batteries; Argonne, IL, USA (5 Nov 1985).

There is a critical composition within the β-phase domain corresponding to 50.7 at. % Li. This composition partitions the Li-conduction mechanism problem into four regions: room temperature (RT) for $x < 0.507$, RT for $x > 0.507$, high temperature (HT) for $x < 0.507$, and HT for $x > 0.507$. The point defects and dimeric defects necessary to account for observed variations in Li diffusion have been determined for the first 3 regions; the fourth region is still being investigated. (DLC)

11368 **(CONF-8509154—Summs.) First international workshop on battery testing. Workbook and extended abstracts. Summaries.** Estand, E. (comp.). (Argonne National Lab., IL (USA)). Sep 1985. Contract W-31-109-ENG-38. 197p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86001615.

From International battery testing workshop; Heidelberg, F.R. Germany (29 Sep 1985).

Thirty-nine papers are presented under the following session headings: international overview; general testing procedures; testing of special battery systems; accelerated life cycle tests; instrumentation, hardware, equipment; post-test analyses, thermal management; and field testing and correlating laboratory tests with on-board EV tests. (DLC)

11369 **(DOE/ET/25102—T1) Sodium-sulfur battery development. Phase VB, October 1, 1981-February 28, 1985. Final report.** (Ford Aerospace and Communications Corp., Newport Beach, CA (USA). Aeronutronic Div.; Ford Motor Co., Newport Beach, CA (USA). Aeronutronic Div.). 4 Oct 1985. Contract AT04-79ET25102. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86003484.

The program addressed the development of Na/S batteries for stationary energy storage (SES) and electric vehicle (EV) applications, although during Phase VB the EV application was emphasized. Phase VB technical achievements are summarized as follows: Cell Development, Electrolyte Development and Production, and Battery Development.

11370 **(EPRI-EM—4341) Posttest analysis of beta (Na/S) cells from chloride silent power, limited. Final report.** Battles, J.E.; Mrazek, F.C. (Argonne National Lab., IL (USA)). Dec 1985. Contract W-31-109-ENG-38. 78p. NTIS, PC A05/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE86004395.

Researchers have developed a unique methodology for examining sodium/sulfur cells after testing to learn more about their behavior. The new techniques described in this report allow scientists to discern the physical and chemical states of these high-energy cells and to develop hypotheses about degradation mechanisms. This information may provide a basis for building cells with longer lives.

11371 **(PNL—5678) Energy Storage Technical and Economic Analysis Program. Annual report.** (Pacific Northwest Labs., Richland, WA (USA)). Nov 1985. Contract AC06-76RL01830. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004182.

The DOE Energy Storage program over the last several years has evaluated a large number of energy storage technologies, developed promising technologies, and successfully transferred new technologies to the private sector. In FY 1985 specific tasks involved in this area included: Battery Systems Requirements Analysis, Statistical Analysis of Battery Failures, and Research Needs for Corrosion Control and Prevention in Energy Conservation Systems. Battery cost analysis, R and D planning, and technology transfer/market analysis are also reported.

11372 **(SAND—85-1446) Exploratory Battery Technology Development and Testing report for 1984.** Magnani, N.J.; Clark, R.P.; Bush, D.M.; Butler, P.C.; Chamberlin, J.L.; Freese, J.M.; Grothaus, K.R.; Murphy, K.D.; Shoemaker, P.E. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1985. Contract AC04-76DP00789. 97p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86003188.

Sandia National Laboratories, Albuquerque, has been designated as Lead Center for the Exploratory Battery Technology Development and Testing Project, which is sponsored by the US Department of Energy's Office of Energy Storage and Distribution. In this capacity, Sandia is responsible for the engineering development of advanced rechargeable batteries for both mobile and stationary energy storage applications. This report details the technical achievements realized in pursuit of the Lead Center's goals during calendar year 1984.

11373 **(UCID—20495) Aluminum-Air Power Cell: the M4-cell assembly and initial tests.** Maimoni, A.; Muelder, S.A.; Hui, W.C. (Lawrence Livermore National Lab., CA (USA)). 3 Oct 1985. Contract W-7405-ENG-48. 46p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86003182.

We fabricated, assembled, and tested the modular, wedge-shaped M4 Aluminum-Air Power Cell in a system with a fluidized-bed crystallizer and hydrocyclone separator. Two M4-cell experiments validated the design premises and indicated predictable performance. The combined duration of the M4-1 and M4-2 experiments was almost 9 h. Conductive epoxy bonds are inadequate for bonding the air-cathode metal screen to current collectors; soldered joints using low melting (93°C) Indium solder performed satisfactorily. Both experiments were terminated because of problems directly traceable to metallic tin deposited by the stannate corrosion inhibitor. Apart from problems caused by metallic tin, the M4-2 test system performed very satisfactorily. Individual cell pods are readily assembled into single or multicell stacks; it is easy to disassemble the cells after a run to determine cell condition. Air-cathode assembly is the most cumbersome aspect of the M4 cell. We obtained valuable information regarding the evolution of particle-size distribution. We did not observe substantial agglomeration of the smaller crystals. A simple model of secondary nucleation gave a reasonably good fit to the secondary nucleation observed in the M3-3 experiment.

29 ENERGY PLANNING AND POLICY

11374 **(AD-A—158855/7/XAB) USAWC (United States Army War College) military studies program paper. Petroleum management in support of combat forces. Student essay.** Bila, R.V. (Army War Coll., Carlisle Barracks, PA (USA)). 1 May 1985. 28p. NTIS, PC A03/MF A01.

The paper examines the bulk-petroleum distribution system in the CORPS area of operations. Present general-support force structure in the CORPS is examined to determine if it would be possible to use its increased productivity to provide both general and direct support to combat formations, thereby eliminating the need for the divisional direct-support units. The requirement to have highly mobile combat divisions and the ever increasing demand for bulk fuel indicates that petroleum-supply points and distribution means must be flexible, redundant, and highly tailorable. The paper concludes that, if planned actions to increase the productivity of the petroleum-supply company are accomplished, this unit offer sufficient capability to support in a general and direct support role for both light and heavy combat units. Data were gathered from current petroleum and supply manuals, Department of Army productivity plans, and TRADOC briefings.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 10959, 11377, 11392, 11398

11375 **Engineering/economic end-use energy models.** Hamblin, D.M.; Vineyard, T.A. (Oak Ridge National Lab., TN). *AIP (American Institute of Physics) Conference Proceedings;* No. 135, 52-80(1985). (CONF-850414—).

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

The objective of this paper is to provide a glimpse of the current technology of engineering/economic end-use energy models. In providing this glimpse, it was found desirable to articulate three subsidiary objectives. The first objective describes end-use modeling within the broader context of an analytical framework capable of producing statistically sound and valid forecasts. The second objective highlights those aspects of the end-use modeling problem that are associated with technology and technology characterization. The third objective describes results of a policy application. The authors hope that the latter two objectives provide insights to the physics community concerning how and how well their inputs to the end-use modeling problem are employed. 19 references, 3 figures, 2 tables.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 10932, 10936, 11375, 11392, 11455

11376 **(DOE/EI/19680—T2) Financial and Compliance Report on Federally Assisted Programs for the year ended June 30, 1984.** (Minnesota State Government, St. Paul (USA)). 1984. Contract FG01-84EI19680. 122p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86003116.

This report includes all federal assistance received by the state departments and agencies determined to be a part of the state's reporting entity except for the college and university programs discussed above. The National Council on Governmental Accounting's (NCGA) Statement 3: Defining the Governmental Reporting Entity provides what criteria used in defining the state's reporting entity. All federal programs within this reporting entity

were included under the single audit except as discussed above. Because of the high degree of autonomy of the University of Minnesota, it is not considered a part of the state's reporting entity and therefore we have not included federal assistance for the University. In fiscal year 1984 the State of Minnesota received approximately $1.5 billion in federal asistance for its many programs. Major programs include Income Maintenance, Medical Assistance and Social Service Block Grants in the Department of Education; Highway Planning and Construction in the Department of Transportation; Lower Income Housing Assistance in the Housing Finance Agency; and Low Income Energy Assistance in the Department of Economic Security and the Department of Energy and Economic Development.

11377 **(PB—85-237311/XAB) Issues in the appraisal of energy projects for oil-importing developing countries. World Bank staff working paper.** Anand, S.; Nalebuff, B. (International Bank for Reconstruction and Development, Washington, DC (USA)). 1985. 81p. (WP—738). NTIS MF A01.

The paper develops a theoretical framework to evaluate the benefits and costs of energy projects in oil-importing developing countries (OIDCs). The framework is used to address various questions: How should the problems of energy dependency and vulnerability be reflected in a project appraisal. Are there externalities not captured in the market price of the resource. Should royalty values be included in cost-benefit calculations. Why do the real prices of exhaustible resources rise over time. Should several energy development projects be done simultaneously. What are the true costs of stockpiling oil. Is there a need for an international institution to act as coordinator directing a strategy for information gathering and project diversification across countries.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 10938, 10964, 11873

11378 **(GAO/RCED—85-86) Status of EPA's remedial cleanup efforts.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 20 Mar 1985. 12p. US General Accounting Office, Box 6015, Gaitherburg, MD 20760. File Number TI86900181.

The objectives were to determine the extent to which the Environmental Protection Agency (EPA) believes cleanup has been completed at priority sites, and the status and funding of ongoing remedial efforts. (ACR)

2904 Natural Resources

REFER ALSO TO CITATION(S) 11138

11379 (DOE/METC—85/5, pp 599-603) **Energy perspectives - 1984.** Adams, M.R. (BDM Corp., McLean, VA). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

This paper discusses the development and advances made in energy prioritization and technology made under the Market Oriented Program Planning Study (MOPPS) of the Energy Research and Development Administration. It presents the technology advancements made in oil shale and coal gasification and the economic aspects of these technologies. The paper also compares the cost effectiveness of renewable resource developments to more expensive oil shale retorts or coal gasification projects. Energy and technology assessments and developments for the near future are also given.

11380 **Proposed fiscal year 1986 budget request. Hearings before the Committee on Energy and Natural Resources, United States Senate, Ninety-Ninth Congress, First Session, February 27, March 1 and 4, 1985.** Washington, DC; Government Printing Office (1985). 1244p.

The Secretaries of Interior, Energy, and Agriculture, and representatives of the Synthetic Fuels Corporation, and the Federal Energy Regulatory Commission were the principal witnesses at a three-day hearing on the 1986 budget proposal. Of concern to the committee were the policy implications of budget reductions of recent years and the government's role as steward of natural resources. At issue was how to reconcile deficit reduction with other public goals and develop a national consensus on the proper role of the federal government. Among the topics under discussion were the leasing of land for energy development and timber harvesting, the strategic petroleum reserve, conservation and weatherization programs, and the management of minerals, water, and other resources. There are six appendices with responses submitted for the record as well as the testimony of the witnesses.

11381 **Bureau of Mines authorization and oversight. Hearing before the Subcommittee on Transportation, Aviation and Materials of the Committee on Science and Technology, US House of Representatives, Ninety-Ninth Congress, First Session, April 24, 1985.** Washington, DC; Government Printing Office (1985). 215p.

This hearing was held as a result of an administration proposal which would decrease the 1986 Budget of the US Bureau of Mines by an amount which would require a reduction of staff amounting to 155 people. The programs and achievements of the Bureau are described in some detail and also its responsibilities in case of emergency. In addition, the rather depressed state of the US metal industry (copper, steel, molybdenum, nickel, etc.) is described, relative to the competition from developing countries with high grade ore and very low labor costs, the high value of the US dollar, etc. (LTN)

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 10743, 10744, 10745, 10747, 10748, 10749, 10750, 10751, 10752, 10753, 10754, 10761, 10763, 10766, 10768, 10770, 10771, 10775, 10776, 10777, 10833, 10834, 10837, 10850, 10884, 10892, 11124, 11137, 11199, 11376, 11397, 11404, 11405

11382 (CONF-8411226—Trans., pp 17-101) **Refrigeration technology laboratories introduce themselves.** Steimle, F.; Schmidt, E.L.; Kruse, H.; Merker, G.P.; Gorenflo, D.; Schulz, S.; Winter, E.R.F.; Greiner, M.; Krug, N.; Boehm, P. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

10 refrigeration technology laboratories domiciled in the Federal Republic of Germany are introduced in separate papers. These each contain details of the number of people employed, the equipment available and the areas of work handled. Their activities are also presented (research commissions, own research, commissioned or self-initiated development work, official reports and studies). Brief information on the commissioning bodies for research (public and private) is given. Finally, special research and development work or the results of such work in recent years are presented.

11383 **(DOE/ER/10250—T6) Hawaii Natural Energy Institute annual report, July 1981-June 1982.** Brown, N.E. (ed.). (Hawaii Univ., Honolulu (USA). Hawaii Natural Energy Inst.). 1982. Contract FG03-81ER10250. 93p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86004247.

This report includes brief progress reports on the 35 research and development projects in geothermal energy, ocean energy, biomass energy, wind energy, solar energy, and other renewable energy sources. (DLC)

11384 **(DOE/ER/10250—T7) Hawaii Natural Energy Institute annual report, 1984.** (Hawaii Univ., Honolulu (USA). Hawaii Natural Energy Inst.). 1984. Contract FG03-81ER10250. 73p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004246.

Research and development project summaries are given on: biomass energy, geothermal energy, ocean energy, solar energy, wind energy, hydrogen research, other renewable energy. (DLC)

11385 **(DOE/IR/10425—T2) Program and financial report on Department of Energy.** (Council of Energy Resource Tribes, Englewood, CO (USA)). Mar 1982. Contract FG01-78IR10425. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86002047.

Under the FY81 Department of Energy Interagency Grant, the Council of Energy Resource Tribes (CERT) has conducted 166 tribal technical assistance projects at a total cost of $1,300,000. During FY81, CERT further developed its technical assistance and policy analysis capabilities through the addition of several new key staff members and the refinement of organizational procedures. CERT transferred its operational headquarters to its Englewood, Colorado office, an effort which has realized both an organizational cost savings and increased responsiveness to CERT member tribes. Also during FY81, CERT's membership has increased from 26 to 29 member tribes. The following report details CERT's programmatic accomplishments and provides a budget analysis for FY81 activities.

11386 **Fiscal year 1986 Department of Energy authorization (fossil energy). Volume 1. Hearing before the Subcommittee on Energy Development and Applications of the Committee on Science and Technology, US House of Representatives, Ninety-Ninth Congress, First Session, March 6, 1985.** Washington, DC; Government Printing Office (1985). 336p.

Volume I covers testimony by William A. Vaughan of DOE and two panels representing the gas and utility industries and their various research organizations. At issue was the administration's proposal to cut the 1985 DOE appropriations of $347 million by 30% for 1986 and the concern that energy research funding be applied as efficiently and effectively as possible. While recognizing the need to slow federal spending, the committee's concerns centered on the possibility that budget cuts will slow and disrupt the progress made on several fossil fuel technologies. Vaughan described the budget proposal in terms of fiscal priorities that focus on coal research, programs which exceed private sector capability, stabilizing research funding, balancing the mix of recipients and encouraging university/industry cooperation, emphasizing cost sharing with the private sector, and reducing the environmental impacts of coal. Two appendices with additional material for the record follow the testimony of the 10 witnesses.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 11347, 11853, 12424

11387 **(AD-A—158598/3/XAB) Ingredients of deterrence. Student paper.** Travis, S.B. (Army War Coll., Carlisle Barracks, PA (USA)). 25 Apr 1985. 57p. NTIS, PC A04/MF A01.

The purpose of this study is to determine what ingredients are required for a successful strategy of deterrence, evaluate the necessity of nuclear weapons for a deterrent strategy and examine the relationship between deterrence and the absence of East-West open hostilities. Since the development of nuclear weapons, much has been written about the use of deterrence to influence the actions of other states, and today it is said to be the cornerstone of our strategic nuclear policy. Information was gathered by reviewing existing literature on the subject. The focus of the study was to identify what elements are necessary for a theoretical strategy of deterrence and then consider the necessity of nuclear weapons to the use of a deterrent strategy today and determine if deterrence is responsible for the absence of open hostilities between the U.S. and the U.S.S.R. The study identified nineteen essential ingredients, grouped into five categories, and concluded that nuclear weapons are required for a U.S. strategy of deterrence today. The study concluded that there is insufficient information to prove that deterrence is responsible for the absence of conflict, but that it is reasonable to assume that deterrence has at least been a factor in preserving peace.

11388 **(AD-A—158912/6/XAB) Some thoughts on deterrence.** Vick, A. (RAND Corp., Santa Monica, CA (USA)). Oct 1983. 25p. NTIS, PC A02/MF A01.

This paper offers a brief review and discussion of the fundamentals of deterrence theory. It offers an alternative and, it is argued, more realistic method for calculating expected value.

11389 **(CONF-860205—3) Emergence of interest groups on hazardous waste siting: how do they form and survive.** Williams, R.G.; Payne, B.A. (Argonne National Lab., IL (USA)). 30 Oct 1985. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004045.

From 8. symposium on geotechnical and geohydrological aspects of waste management; Ft. Collins, CO, USA (5 Feb 1986).

This paper discusses the two components of the facilitative setting that are important for group formation. The first component, the ideological component, provides the basic ideas that are adopted by the emerging group. The ideological setting for group formation is produced by such things as antinuclear news coverage and concentration of news stories on hazardous waste problems, on ideas concerning the credibility of the federal government, and on the pervasivensee of ideas about general environmental problems. The organizational component of the facilitative setting provides such things as leadership ability, flexible time, resources, and experience. These are important for providing people, organization, and money to achieve group goals. By and large, the conditions conducive to group formation, growth, and survival are outside the control of decision-makers. Agencies and project sponsors are currently caught in a paradox. Actively involving the public in the decision-making process tends to contribute to the growth and survival of various interest groups. Not involving the public means damage to credibility and conflict with values concerning participatory democracy. Resolution in this area can only be achieved when a comprehensive, coordinated national approach to hazardous waste management emerges. 26 refs.

11390 **(CONF-8410315—) Nuclear power in the Midwest: proceedings of the twelfth annual Illinois Energy Conference.** (Illinois Univ., Chicago (USA). Energy Resources Center). 1984. Contract FG02-84CH10221. 232p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE86004171.

From 12. annual Illinois energy conference; Chicago, IL, USA (31 Oct 1984).

Sessions were devoted to: nuclear waste disposal; power plant safety, decommissioning, and waste transportation; economics of nuclear power; and alternatives to nuclear power. Separate abstracts were prepared for 19 papers.

11391 **(NUREG/CR—4344) Instructional skills evaluation in nuclear industry training.** Mazour, T.J.; Ball, F.M. (Analysis and Technology, Inc., North Stonington, CT (USA)). Nov 1985. 122p. NTIS, PC A06/MF A01 - GPO. File Number TI86900416.

This report provides information to nuclear power plant training managers and their staffs concerning the job performance requirements of instructional personnel to implement prformance-based training programs (also referred to as the Systems Approach Training). The information presented in this report is a compilation of information and lessons learned in the nuclear power industry and in other industries using performance-based training programs. The job performance requirements in this report are presented as instructional skills objectives. The process used to develop the instructional skills objectives is described. Each objective includes an Instructional Skills Statement describing the behavior that is expected and an Instructional Skills Standard describing the skills/knowledge that the individual should possess in order to have achieved mastery. The instructional skills objectives are organized according to the essential elements of the Systems Approach to Training and are cross-referenced to three categories of instructional personnel: developers of instruction, instructors, and instructional managers/supervisors. Use of the instructional skills objectives is demonstrated for reviewing instructional staff training and qualification programs, developing criterion-tests, and reviewing the performance and work products of individual staff members. 22 refs.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 11082

2910 Conservation

REFER ALSO TO CITATION(S) 11443, 11449, 11450, 11451, 11452, 11453, 11454, 11455, 11456

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 10933, 10934, 10935, 10961, 10962, 11375

11392 **(DOE/EI/19658—1) Model documentation for the Mini-Macroeconomic Model: MINMAC.** Moody, C.E. Jr.; Curtis, W.P. (Orkand Corp., Silver Spring, MD (USA)). 1985. Contract AC01-84EI19658. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86005370.

This macroeconomic component of the Intermediate Future Forecasting System (IFFS) provides forecasts of deviations from a given base case for 19 aggregate macroeconomic variables and other more detailed sectoral and regional economic variables used for energy demand forecasts. MINMAC also includes modules for generating sectoral and regional economic detail. The industrial output module uses relations estimated from historical data to forecast levels of output in 20 manufacturing industries at the 2-digit Standard Industrial Classification (SIC) level, as well as incorporating energy feedbacks into exogenously specified forecasts for certain other sectors needed by IFFS. Output levels for manufacturing, national disposable income, and population forecasts are then allocated to states and regions using shares forecasted by the regional sharing module, based on projections of the Department of Commerce.

11393 **(DOE/OR/00033—T166) Identification of state-level energy data available from the Energy Information Administration, Private Sector Sources, and State Offices.** Boercker, F.; Bodine, F. (Oak Ridge Associated Universities, Inc., TN (USA)). Sep 1981. Contract AC05-76OR00033. 483p. NTIS, PC A21/MF A01; 1; GPO Dep. File Number DE86003025.

An inventory of state-level energy data is presented in this report, which is part of the Southern States Energy Data Project. The purpose of the report is to identify primary state-level energy data. The data systems of the Energy Information Administration (their collection forms and publications), major private sector organizations, and state offices in the southern region were investigated. Seventy-four EIA forms were found to collect state-level energy data on a periodic basis. There were 46 EIA and 32 private sector publications identified that publish state-level enery data on a periodic basis. The information was classified at the table level using the National Energy Information System's faceted classification scheme. The report includes a discussion of the timeliness of the data, its geographic aggregation, and the primary sources of the data. The 14 report appendixes catalog state-level energy data. Several formats are used to aid the reader in identification of needed data.

11394 **(NP—6770068) Greece - energy situation 1983/1984.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jul 1985. 20p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE86770068.

The energy situation of Greece is reviewed on the basis of relevant data. Some remarks on the country's national and international energy supply policy are followed by an outline of trends in energy sources and electric power generation. Important figures are presented on external trade and the balance of payments.

11395 **(NP—6770069) Indonesia - energy situation 1983/1984.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jun 1985. 28p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86770069.

The energy situation of Indonesia is reviewed on the basis of relevant data. Some remarks on the country's national and international energy policy are followed by an outline of trends in energy sources and electric power generation. Important figures are presented on external trade and the balance of payments.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 10936, 11127, 11135, 11380, 11386, 11394, 11395, 11404, 12424

11396 **DOE's fiscal year 1986 budget. Hearings before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Ninth Congress, First Session.** Washington, DC; Government Printing Office (1985). 560p.

Three days of hearings covered general oversight review, the radioactive waste management program, and the Federal Energy Regulatory Commission (FERC), with testimony from representatives of DOE, FERC, the Office of Technology Assessment, and the General Accounting Office. Energy Secretary Herrington reviewed the DOE budget request in terms of national energy as well as national deficit-reduction goals. A major component of the reduced budget is the moratorium on developing and filling the strategic petroleum reserve. Other reductions have come from uranium enrichment programs, termination of the Clinch River breeder program, and the shift of renewable technologies to the private sector. Testimony on nuclear waste policy focused on the designation of three sites for retrievable storage of spent fuel. FERC spokesmen described efforts to reduce operating costs and streamline licensing procedures. Material submitted for the record follows the testimony of 11 witnesses.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 10833, 10834, 10837, 10850, 10884, 10892, 10932, 10933, 10934, 10935, 10936, 10959, 10961, 10962, 10963, 11150, 11386

11397 **(DOE/METC—85/5, pp 7-10) Industry's role in exporting UCG technology.** Penland, R.K.; Daniel, J.H. (Gulf Oil Corp., Houston, TX). Dec 1984. NTIS, PC A99/MF A01. File Number DE85001956. (CONF-840835—).

From 10. annual underground coal gasification symposium; Williamsburg, VA, USA (12 Aug 1984).

This paper summarizes the potential for the development of underground coal gasification (UCG) both in the US and abroad. With the current technology available but falling energy prices in the US, UCG interests in the foreign countries is elaborated on. The paper discusses potential candidates for the UCG projected cost estimates for production. In order for technology transfer to be effective, there has to be a real need; the technology must be applicable; and there must be a commercial basis with well defined benefits for all parties concerned. This criteria which makes for successful technology transfer is expanded.

11398 **Model of the use of coal, gas, and oil.** Thode, H.C. Jr.; Kydes, A.S.; Finch, S.J. (Brookhaven National Lab., Upton, NY). *Energy (Oxford);* **10**: No. 5, 635-641(1985). Contract AC02-76CH00016.

A methodology for model simplification is described, which uses the pseudo-data approach and known statistical techniques. An analysis of pseudo-data generated from the Brookhaven Energy System Optimization Model (BESOM) was undertaken to determine the interrelationship of imported oil use with coal and gas use in that model. The simplified model is tested by projecting the imported oil needed for levels of coal and gas use consistent with the national restrictions embodied in BESOM. Projections of the derived functions were verified with full-scale BESOM runs. The effects of gas and coal prices on oil use are shown. 8 references, 2 figures, 2 tables.

2960 Electric Power

REFER ALSO TO CITATION(S) 11218, 11450, 11453

11399 (EPRI-EA—4031) Forecasting in an era of technological change: proceedings of fifth forecasting symposium. (Battelle Columbus Labs., OH (USA)). May 1985. 353p. (CONF-8310414—). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920825.

From 5. forecasting symposium on forecasting in an era of technological change; Boxborough, MA, USA (18 Oct 1983).

The rapid technological and structural changes of the 1980s call for load-forecasting methods that can assess the effects of such changes. The fifth symposium on load forecasting brought together people from many fields to share their experiences with current methodologies and to explore the outlook for residential, commercial, and industrial electricity use.

11400 (EPRI-EA—4355) NERC summary load forecasts: a retrospective appraisal and technical analysis. Final report. Uhler, R.G.; Nelson, C.R. (National Economic Research Associates, Inc., White Plains, NY (USA); Washington Univ., Seattle (USA)). Dec 1985. 70p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920081.

Using retrospective forecasting, this report analyzes the electric energy and peak demand summary forecasts of the North American Electric Reliability Council (NERC). The authors examine the NERC summary load forecasts from 1974 to 1983 for the electric utilities in the United States. The optimism of the industry's forecasts - which turned out to be wrong - may have been due to the unanticipated slowdown in the growth of the economy and either the unexpected permanence of higher electricity prices or a lack of recognition of the full extent of demand's sensitivity to price.

11401 (EPRI-EM—4389) Value-based utility planning: scoping study. Final report. Levy, R.D.; Sanghvi, A.P. (Levy Associates, Sacramento, CA (USA); Meta Systems, Inc., Arlington, VA (USA)). Jan 1986. 50p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI86920115.

What services and products do consumers really value. Until now, that question has had little place in utility planning schemes. But the development of planning techniques based directly on customer preferences could help utilities identify more-effective market strategies, rate options, and products in an increasingly competitive environment.

11402 (NP—6900308) 1985 Annual data summary report for the regional reliability councils of NERC. (North American Electric Reliability Council, Princeton, NJ (USA)). 1985. 112p. North American Electric Reliability Council, Terhune Rd., Princeton, NJ 08540. File Number TI86900308.

One of the major activities of the Electric Council is the annual collection and publication of utility forecasts of electric power supply and demand. This report provides these data. The data summarized in this report are aggregations of the forecasts developed early in 1985 by the individual utility members of the Regional Reliability Councils. Data for the MAIN, NPCC, SERC, SPP, and WSCC Regions are broken down and presented in Subregional tables following each Regional table.

11403 (NP—6900327) Review of bulk power system reliability in North America. 1985 Reliability review. (North American Electric Reliability Council, Princeton, NJ (USA)). 1985. 69p. North American Electric Reliability Council, Terhune Rd., Princeton, NJ 08540. File Number TI86900327.

The North American Electric Reliability Council expects the reliability of electric supplies to decline over the next ten years. By the mid-1990's, electric generating capacity margins will be near minimum acceptable levels in some parts of the United States, even if electricity demands grow no faster than the present forecast rate of 2.2% per year. In Canada, generating capacity is judged to be adequate for the entire 1985-1994 period. Peak demand and energy generating capacity and fuel, assessment of power supply adequacy, transmission issues, operations, and regional assessments of reliability are discussed.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 10933, 10934, 10935, 10962, 10963, 11393

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 11124, 11127, 11135, 11137, 11138, 11150, 11195, 11199, 11450

11404 (CEER-X—163, pp vp) State of solar energy technology. Block, D.L. (Florida Solar Energy Center, Cape Canaveral). 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

This paper presents an assessment of the state of solar energy technology based upon the experiences of the Florida Solar Energy Center and upon the results of a US Department of Energy funded solar technology assessment project. The Florida Solar Energy Center is the focal point of Florida's solar energy activities. Major program areas of the Florida Solar Center include photovoltaics, low energy building design, testing and certification of solar equipment, OTEC and education and training of solar practitioners. The Solar Technology Assessment Project (STAP) completed one year ago, commissioned 12 nationally recognized solar experts to assess and present a paper on their particular area of expertise. The project emphasized the importance of the nation's solar programs and sought to impact future energy policy decisions. The Florida solar experience and STAP have been used to establish the following priorities for solar energy technology development: high - photovoltaics, passive heating and cooling, biomass; intermediate - water and space heating, OTEC, wind, solar thermal central receiving; low - industrial process heat, active cooling by thermal processes. It is recommended that first and second priority programs must be continued, that solar research and development must include near-term technologies; and that governmental energy policies and support must be stable and consistent. The technologies with the greatest market potential will automatically survive and prosper; those without potential will fail. Emphasis must be placed on government supported research.

11405 (DOE/ER/10250—T5) Hawaii Natural Energy Institute annual report, July 1982-June 1983. (Hawaii Univ., Honolulu (USA). Hawaii Natural Energy Inst.). 1983. Contract FG03-81ER10250. 103p. NTIS, PC A06/MF A01; GPO Dep. File Number DE86004245.

This report presents summaries of 37 projects in biomass energy, solar energy, geothermal energy, ocean energy, wind energy, and other renewable energy sources. (DLC)

30 DIRECT ENERGY CONVERSION

3005 Fuel Cells

11406 (DOE/ER/10909—1) Molten carbonates: microwave studies of the vapor state. Final report. Gillies, C.W. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Chemistry). Aug 1985. Contract AC02-81ER10909. 125p. NTIS, PC A06/MF A01; GPO Dep. File Number DE86004504.

A high temperature microwave spectrometer was developed for the analysis of the vapor above alkali carbonates in fuel cell environments. The absorption cell utilizes nickel foil and a novel support system for the Stark septum. Both Stark modulation and radio-frequency-microwave double resonance (RFMDR) were employed for the observation of the $J = 1 \rightarrow 2$ transitions of potassium hydroxide in several vibrational states. This is the first application of

RFMDR techniques at high temperature. The analysis of the hyperfine structure due to nuclear quadrupole splitting of the J=1→2 transitions yielded quadrupole data for the ground state and the first excitations of the K-0 stretch and the degenerate bonding modes. For the ground state the unsplit frequency ν_0=32,834.33(5)MHz and eQq = 7.19(8)MHz. The unsplit frequencies for all states observed are consistent with rotational and distortion constants obtained from higher J transitions. Experiments with the 62 to 38 mole percent lithium-potassium carbonate eutectic in gas atmospheres which maximize the potassium hydroxide vapor concentration have failed to identify the J = 1→2 transition of monomeric potassium hydroxide. Sensitivity estimates of the high temperature microwave spectrometer indicate that the potassium hydroxide concentrations fall below the detection limit in typical fuel cell gas atmospheres. 46 refs., 19 figs., 17 tabs.

11407 (DOE/ET/11304—35) Development of molten carbonate fuel cell technology. Technical progress report for the quarter January-March 1985. (Energy Research Corp., Danbury, CT (USA)). 1985. Contract AC02-76ET11304. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004849.

Significant progress has been made during this quarter in the areas of creep resistant anode development, internal reforming catalyst development and tape cast matrix cell testing. Accelerated creep testing of Ni-Al anodes and alternative Ni-Y_2O_3 dispersion strengthened anodes was carried out. A process for reducing Ni-Al powder size has been developed. α-$LiAlO_2$/12% Ni catalyst has been tested for over 1100 hours in an out-of-cell reactor. Initial studies of electrolyte tolerance of internal reforming catalysts show improved tolerance of α-$LiAlO_2$/Ni catalyst compared to commercial MgO/Ni catalyst. Tape cast matrix testing with sheet metal current collectors demonstrated three thermal cycles in a 1200 hour test with terminal nitrogen crossover of only 0.25%.

11408 (DOE/MC/49941—1833) Fuel cell power plant designs: a review. Krumpelt, M.; Minkov, V.; Ackerman, J.P.; Pierce, R.D. (Argonne National Lab., IL (USA)). Nov 1985. Contract W-31-109-ENG-38. 58p. (ANL—85-39). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004295.

Eight conceptual designs for fuel cell power plants were reviewed and analyzed. Of these eight designs, five are for utility baseload applications (150 to 1430 MW) using coal as fuel, and the other three cover dispersed generator applications (1.8 to 11 MW) using natural gas as fuel. The fuel cell types for these designs were either phosphoric acid, molten carbonate, or solid oxide. Estimates of capital and operating costs for the eight plants were adjusted to the same basis, and assumed performances of fuel cells and other important components were critically reviewed. Costs of electricity for the smaller dispersed generator plants were found to be close to those for large central-station facilities. 14 refs., 11 figs., 10 tabs.

11409 (DOE/NASA/0255—1) Onsite 40-kilowatt fuel cell power plant manufacturing and field test program. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Feb 1985. Contract AI21-80ET17088. 155p. (NASA-CR—174988). NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86004560.

A joint Gas Research Institute and US Department of Energy Program was initiated in 1982 to evaluate the use of fuel cell power systems for on-site energy service. Forty-six 40-kW fuel cell power plants were manufactured at the United Technologies Corporation facility in South Windsor, Connecticut, and are being delivered to host utilities and other program participants in the United States and Japan for field testing. The construction of the 46 fully-integrated power plants was completed in January 1985. The program has provided significant experience in the manufacture, acceptance testing, deployment, and support of on-site fuel cell systems. Initial field test results also show that these experimental power plants meet the performance and environmental requirements of a commercial specification.

11410 (LA—10516-MS) Potential application of fuel cells in the chlor-alkali industry. Altseimer, J.H.; Roach, F.; Anderson, J.M.; Mangeng, C.A. (Los Alamos National Lab., NM (USA)). Aug 1985. Contract W-7405-ENG-36. 101p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86003283.

This report examines the technical, economic, and market potential of fuel cells in a cogeneration configuration in the chlor-alkali industry. It was concluded that the chlor-alkali industry would be a good application of phosphoric acid fuel cell (PAFC) cogeneration systems. The alkaline cell being developed by the Occidental Chemical Corporation was also evaluated, and it was found that that cell might be satisfactory as a power generator but, if the steam requirement is included, not as a cogeneration system. Of the high temperature fuel cells, the molten carbonate type is too costly. The cost data available for the solid oxide high temperature cells was not considered adequate for levelized cost calculations. The best conventional system that is now in use in this industry is the gas turbine combined cycle (GTCC). For all systems the costs of both steam and power were calculated. In a plant representative of today's chlor-alkali technology, the differences between the energy costs for the GTCC and PAFC are not very significant considering some of the cost uncertainties such as the capital costs and the operating and maintenance costs for the, as yet unproven, fuel cells systems.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 11187, 11188, 11196, 11466, 11470, 11474, 11873

11411 (AD-A—158425/9/XAB) Mossbauer studies on LaNi(4.7)Sn(0.3) and its hydride. Oliver, F.W.; Morgan, W.; Hammond, E.C.; Wood, S. (Morgan State Univ., Baltimore, MD (USA)). 15 Apr 1985. 3p. NTIS, PC A02/MF A01.

Mossbauer measurements were made on LaNi(4.7)Sn(0.3) at room and liquid nitrogen temperatures. Experimental data yielded a singlet at room temaperature and a doublet at liquid nitrogen temperature. Spectra of the hydrided sample yielded a doublet at liquid nitrogen temperature with an increase in the quadrupole splitting compared to the unhydrided spectra, but no change in the isomer shift. These data indicate that there is no significant interaction between the tin and the hydrogen. The magnetic character remained the same down to liquid nitrogen temperature as evidenced by the Mossbauer data. X-ray-diffraction measurements on the hydride showed and expanded lattice with the same structure as found for the unhydrided sample. A decrease in particle size was observed upon hydriding.

11412 (BNL—51871) Thermal distribution and utilization: an interim progress report. Andrews, J.W.; Fleck, B.H.; Krajewski, R.F.; McDonald, R.J. (Brookhaven National Lab., Upton, NY (USA)). Feb 1985. Contract AC02-76CH00016. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005293.

This is the first of a series of reports describing technical progress of a research program titled Thermal Distribution and Utilization, sponsored by the US Department of Energy. The subject of the research is the building systems used to distribute heat and cooling from central equipment to building spaces, and the control of these systems to provide thermal comfort while minimizing the expenditure of primary energy. This report describes the 1985 plan of work, and reports on technical progress through January 1985. An introductory section outlines the energy-impact projections upon which the program is based.

11413 **(BNL—51943) Condensing heat exchanger systems for residential/commercial furnaces and boilers. Phase IV.** Razgaitis, R.; Payer, J.H.; Talbert, S.G.; Hindin, B.; White, E.L.; Locklin, D.W.; Cudnik, R.A.; Stickford, G.H. (Battelle Columbus Labs., OH (USA)). Oct 1985. Contract AC02-76CH00016. 212p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86004833.

The development of condensing heat exchanger systems is studied. In the work reported here, the focus is on the corrosion resistance of materials to condensate produced by gas-fired heating equipment, and the characterization of the spatial variation of condensation corrosivity in condensing heat exchangers.

11414 (CONF-850386—Pt.1, pp 27-46) **Multi-family houses with built-in conservatories.** Eggenberger, A. Mar 1985. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86770067.

From Passive and hybrid solar low energy building design - Swiss IEA results; Zurich, Switzerland (28 Mar 1985).

In the winter of 1983/84 between October 1983 and April 1984, the measuring campaign entitled 'Thermic measurements on conservatories in multi-family houses' was carried out. It was concentrated on existing, continuously occupied buildings. The results of the measurements can provide answers to the following questions: What sort of climate is formed in the conservatory in dependence on the external climate. How does the occupier influence this climate in regard to energy gains and how frequently is the conservatory climate suitable for occupation. The results of the measuring campaign are presented in compressed form. Similarly, the knowledge gained from it is summarised. In the measurement report, more details of the buildings studied, the measuring concept and the results of the measurements are to be found.

11415 (CONF-850386—Pt.1, pp 47-65) **Parametric studies: Direct-gain windows, conservatories and convective systems.** Filleux, C.; Grolimund, R. Mar 1985. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86770067.

From Passive and hybrid solar low energy building design - Swiss IEA results; Zurich, Switzerland (28 Mar 1985).

The dynamic simulation programme known as SERIRES was used to analyse various passive solar systems. The experiments were carried out on a building model for a terrace house as specified by the IEA and adapted to conditions in Switzerland in the four climate zones Geneva, Zurich, Davos and Lugano. For the direct-gain concept, variations in the type of glazing, the window dimensions, night insulation, thermic comfort requirements etc. were introduced; for the conservatory concept, variations such as the type of glazing for the conservatory, the way the dividing wall between conservatory and house is structured were made. The utilisation factor for solar energy was determined for the direct gain model.

11416 (CONF-850386—Pt.1, pp 97-117) **Optimising three building projects by means of passive solar energy: Wald (Canton Zurich), Schuepfen (Canton Berne) and Preverenges (Canton Vaud).** Binz, A.; Guetermann, A. Mar 1985. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86770067.

From Passive and hybrid solar low energy building design - Swiss IEA results; Zurich, Switzerland (28 Mar 1985).

The part of the work of 'IEA Solar VIII: Demonstration' aims at optimising actual building projects with regard to passive solar energy utilisation by means of involving experts and using computer parameter studies. Three projects are presented: a house containing two flats, a terrace house and a block of flats. The optimisation possibilities from computer simulation studies are listed and discussed. It was seen that certain connections can be crystallised out in this kind of calculations. In particular, the dependency of energy consumption and comfort was demonstrated with regard to: type of glazing, quality of frames; choice of system: conservatory, direct gain, outdoor collector, shape, size and design of conservatory and behaviour of occupiers.

11417 **(CONF-851202—1) Statistically based parametric analysis of exterior envelope thermal mass effect predictions.** Christian, J.; Downing, D. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004787.

From DOE-ORNL-ASHRAE-BTECC conference on thermal performance of the exterior envelopes of buildings-III; Clearwater Beach, FL, USA (2 Dec 1985).

Based on DOE Thermal Mass Research, consisting of field measurements, consistency checks, main-frame building simulation model validation and data bases, a simplified prediction procedure is developed for estimating the effect of exterior envelope thermal mass. This procedure is cross checked using a real building and DOE2.1B simulations selected by a fractional factorial experimental design for accuracy and comprehensiveness. This procedure estimates the annual delta load between two buildings with identical characteristics except that one has framewalls, the other insulated mass walls. The delta loads are a function of wall R value and heat capacity. The sensitivity of delta loads to interior mass in the foundation, partition walls and ceiling are examined as well as southfacing window area and use of window insulation. The results of this statistically based parametric analysis show that for buildings with substantial interior thermal mass in excess of that found in typical single family construction the simplified prediction procedure over estimates the exterior wall mass effect. However for frame construction with or without slab foundations and with or without extensive south facing glass the prediction procedure is valid in the mid-southeastern US.

11418 **(CONF-851202—2) BTESM National Program: past, present, and future.** Lundy, T.S. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004769.

From DOE-ORNL-ASHRAE-BTECC conference on thermal performance of the exterior envelopes of buildings-III; Clearwater Beach, FL, USA (2 Dec 1985).

This paper will review some of the history of the National Program for Building Thermal Envelope Systems and Materials (BTESM) indicating key decisions for important components of the Program including such things as creation of the Building Thermal Envelope Coordinating Council (BTECC) and implementation of this series of conferences involving ASHRAE (and now BTECC) as joint sponsors with DOE. Meaningful technical research results and information dissemination to targeted audiences within the total building community are important components of the program operation. This paper also will describe both the formalized technology transfer activities including the holding of institutes for architectural and engineering faculty members and student design competitions and the informal but highly effective person-to-person network of information sharing within the total building community.

11419 **(CONF-851202—3) Dynamic thermal performance of light weight insulated low-slope roof systems.** Courville, G.E.; Sanders, J.P.; Childs, P.W. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004789.

From DOE-ORNL-ASHRAE-BTECC conference on thermal performance of the exterior envelopes of buildings-III; Clearwater Beach, FL, USA (2 Dec 1985).

The thermal performance of an in-service roof is difficult to analyze because complex time-varying boundary conditions prevail at the outer surface of the roof. The Roof Thermal Research Apparatus at Oak Ridge National Laboratory has been built to provide accurate detailed measurements of thermal properties of roof systems exposed to fixed interior conditions and to fully monitored East Tennessee weather on the outside. Absolute and comparative data are presented for well-insulated (R-value about 17 $h.ft^2.F/Btu$) test panels of expanded polystyrene, fiberboard, isocyanurate, and fibrous glass board insulation under built-up roof membranes. Issues discussed include mass effects caused by differing insulation densities, R-value measurement, comparison to steady state calculations, and the relative influence of solar, wind and ambient temperature. Results are compared to numerical solutions of the heat transfer equations.

11420 (CONF-851202—5) **Determinants of actual electricity savings after retrofit: electrically heated homes in the Pacific Northwest.** Hirst, E. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005163.

From DOE-ORNL-ASHRAE-BTECC conference on thermal performance of the exterior envelopes of buildings-III; Clearwater Beach, FL, USA (2 Dec 1985).

A Pacific Northwest utility operated an interim Residential Weatherization Program during 1982 and 1983. The program offered free home energy audits and cash rebates to help pay for installation of recommended retrofit measures in electrically heated homes. The program retrofit almost 104 thousand homes at a cost of almost $160 million. This study analyzes actual electricity savings for homes retrofit by the program. We examine the electricity savings achieved by these homes and the relationships between actual and predicted savings. This involves calculation of summary statistics, comparisons among groups of homes, development of regression models that explain variations across households in actual electricity savings, and examination of individual homes with anomalously large or negative savings. Data are available for nearly 1000 participants.

11421 (CONF-8410367—, pp 164-167) **Thermal insulation and carbon dioxide enhancement in greenhouses.** Hege, H. 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE86770072.

From 42. international meeting on agricultural technology; Neu-Ulm, F.R. Germany (25 Oct 1984).

The heat consumption of four greenhouses with different roofings was measured in an experiment at the Experimental Institute for Horticulture. Among the problems studied were those of light loss under insulated coverings and CO_2 enhancement, for which several different processes were examined. At the same time, consideration was given to the maximum permissible amount of CO_2 generated or fed in, and also to the control of CO_2 enhancement in order to avoid concentration of harmful substances.

11422 (CONF-8411226—Trans.) **Report on DKV annual meeting 1984. Vol. 11.** (Deutscher Kaelte- und Klimatechnischer Verein e.V., Stuttgart (Germany, F.R.)). 1984. 791p. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

At the 1984 annual meeting, expert papers (number in brackets) on the following general subjects were given: Refrigeration technology for the food refrigeration chain (8); Refrigeration in the food industry - individual subjects (9); Account sheets for success in energy saving schemes (13); Practical experience for practical use (6). Some of the titles of lectures (in the sequence of the subject groups) were: Development trends in refrigeration machinery for supermarkets; Vehicle refrigeration; Ways of optimizing refrigeration and deep-freeze machinery energy-wise. Competing conservation processes; Refrigerated foods in bulk containers; Applications for ice storage equipment in the food industry; Industrial bulk refrigerator optimization; The most efficient way of transforming natural gas into heat, cold and electricity; The success balance of energy saving schemes in industry; Air-fed evaporators and liquidators; Expansion bodies in the cooling circuit; Micro-computer control system VS 1000 for compound plant. There is also an introduction to 10 refrigeration technology laboratories. The report contains 46 lectures, for 35 of which a separate summary of contents has been made.

11423 (CONF-8411226—Trans., pp 103-126) **Ways of optimizing refrigeration and deep-freeze equipment energy-wise.** Kuever, M.; Kruse, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

Numerous reports have been published in recent years on possible ways of economising on energy for household refrigerating and deep-freeze appliances. As it has become apparent, however, that discrepancies in the figures stated in these reports and prognoses have occurred, this article comments on six of these 'energy-saving reports' from appliance manufacturers and research institutes and contrasts realistic and unrealistic data of possible energy consumption reductions with one another. The possibilities are mainly related to improving the performance factor of refrigerating components, improving thawing control, reinforcing insulation and higher storage temperatures. By means of lists in the form of tables and diagrammatic explanations, the author reports on mechanical compressors, thermal compressors (absorbers/dischargers), control systems (optimization of period duration, electronic temperature control, heat exchangers (increasing the condensing surface), insulation and door seals (doubling insulation, improvement of airtightness of doors). The future prospects for energy saving possibilities are given for each of these areas that have been studied more closely.

11424 (CONF-8411226—Trans., pp 127-148) **Development trends in refrigeration equipment for supermarkets.** Haaf, S. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

This is an overview of developments taking place at present in refrigeration systems for supermarkets and their consequences in terms of management economy for those using them. For a medium-sized supermarket (with 1000 m^2 sales area) the maximum requirement for all consumers is about 50 kW, of which about 90% goes on cooling agents and the rest on cold rooms. The normal refrigerated section would call for evaporation temperatures of up to -10°C and the freezer area up to -35°C. Generally, air-cooled normal cooling systems working at one level are used. The components involved in the overall energy consumption of refrigeration systems are recirculating air ventilators, lighting, frame and glass heating, and the heating for defrosting. Ways of achieving reductions in energy consumption and running costs for cooling media are improved energy-wise multi-circuit condensers, condensers with axial ventilators, the use of compound cooling systems, compressors with improved quality levels, the improvement of the cooling performance coefficient for freezers, raising the suction pressure in the partial load sector, defrosting devices with pressurised gas and waste heat recycling. Further energy savings could be made by thermotechnical and flow improvements in the components, or by increasing the use of micro-electronics for control and monitoring.

11425 (CONF-8411226—Trans., pp 149-168) **Energy consumption of various different switching systems for compound equipment in supermarkets.** Quast, U.; Kruse, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

A computer programme was devised in order to test whether it is possible to achieve considerable savings in energy by comparison with conventional one-level systems by using two-level refrigeration equipment in supermarkets. It was intended to calculate by means of theoretical comparison processes the cooling performance coefficients of various switching alternatives. The following six switching alternatives were calculated: two-level cooling process with throttle vapour evacuation from the medium pressure vessel; two-level compression with one-level expansion and intermediate injection; two-level compression and one-level expansion (cooling medium sub-cooling); one-level process; combination of two one-level processes; facade circuit. The results of the experiments, which are explained in detail and recorded in a large number of diagrams are those of isentropic calculations (cooling medium comparison, use of heat exchangers, process comparison using different cooling media) and of the actual compression, the mixture face (system switching), system calculation and the one-level process with a cooling medium mixture. The energy savings that could be achieved are set at 12 to 21%.

11426 (CONF-8411226—Trans., pp 169-179) **Central refrigeration for use in supermarkets.** Hoepfer, A. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

This is a presentation of a centrally organised compound system with a screw compressor for generating cold in supermarkets. A central refrigerating unit is described and its special advantages extolled. The refrigerated area comprises cold storage rooms, chilled rooms, refrigerators, wall units, cooling slabs; the overall cooling requirement adds up to 255 kW. Normal refrigeration reaches an evaporation temperature of -10°C, deep-freeze -40°C. The advantages of the compound units for screw compressors are pointed out, the cooling medium for deep freezing is named, and the optimisation potential for further developments is gone into (horizontal compound for normal and deep-freeze cooling). Details of a variation on the central unit, the two-level refrigeration centre version (vertical compound) are given. A freely adjustable performance regulation system for this 'vertical compound' would be possible in combination with a frequency autoconverter, as screw compressors can be adjusted within a very large rev range. In conclusion, the operational safety and economic efficiency of using screw compressor compound units for supermarkets are given particular emphasis.

11427 (CONF-8411226—Trans., pp 219-230) **Evaporators, expansion chambers and defrosting processes for industrial refrigerators.** Blumhardt, R. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

The term 'Refrigerator' covers a large range of different versions and types, the development of which has resulted from specific requirements of storage for different foods, demands for the best possible display of goods and the constant changes in the level of and relationship between energy, staff and buildings. Among different types of refrigerators are refrigerated shelves, refrigerated counterdisplays, fish counters, refrigerated islands, freezer cupboards and chest freezers. The operating conditions for evaporators (performance measurements taken at 25°C and 60% relative humidity; optimization of air exchange; dimensioning criteria for expansion valves) are explained, and so is the way in which evaporators and expansion chambers work together and the defrosting of the evaporator (electric heating, hot gas circulation, liquefying of cooling medium, assessment criteria) is dealt with in conclusion.

11428 (CONF-8411226—Trans., pp 249-265) **Cold: An important factor in the food industry.** Persson, P.O. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

Developments in the refrigeration industry and the food industry have gone hand in hand. 75% of present turnover in the cooling medium industry depends on food and the food industry. Temperature dependency of foods results from microbial, chemical/biochemical and physical aspects. The quality deterioration of various foods in the temperature range -25°C to -5°C was recorded in diagrams. This deterioration process can be seen as an accumulative one. Deep freezing has no competition as the most frequently-used method of universal conservation. Whether refrigerated conservation represents competition for deep-freezing was critically examined. Intervention storage (paid for by the state) of foods has become an important factor in agricultural policy in all countries. What would happen to the use of cold storage buildings if an alternative solution was found in agricultural policy. The retail trade and bulk consumers calculate for 3% freezing costs for their normal food storage. Modulated frosters and machine rooms, heat recycling, electronic controls and cooling tasks in the retail sector are gone into. Within the coming years, freeze engineering will continue as the dominant method for storing food.

11429 (CONF-8411226—Trans., pp 267-275) **Rapid freezing equipment with two-level screw compressor system.** Renz, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

By means of two-level screw compressor systems, low-temperature equipment can be run extremely economically, even in the medium performance range. An optimised oil monitoring and distribution system also guarantees a high degree of operational safety. In addition to the widely-used pracitce of using waste heat for heating water, it can also be used to increase the effectiveness of the defrosting process.

11430 (CONF-8411226—Trans., pp 393-404) **Quantifiability of energy savings.** Bach, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

Energy saving measures on equipment can work in the following 3 directions: reduction of energy for use, reduction of required energy input and reduction of costs for primary energy. The financial investment for energy saving can only be justified on the energy consumption costs saved. 4 rules are stipulated for the reproducibility of energy saving values. A more detailed explanation as to how these rules have to be observed in heating engineering is given. The NEWADA simulation programme is available for simulating a system user or building simulation. It can be used to calculate temperatures and heat flow in a non-transient state with allowance for the actual response of the heating machinery and the actual living conditions. Some examples are adduced to show what energy savings may occur as a result of measures taken on the water heating and of fitting thermostatic valves or a modern boiler, and also of improved thermal insulation in the building or the pipes. The deduction was that energy saving potential cannot be reliably quantified on the basis of firm factors gained from experience.

11431 (CONF-8411226—Trans., pp 425-445) **Low-cost, energy-saving air conditioning systems for department stores and supermarkets.** Pfeiffenberger, U. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

The keeners of competition among department stores and supermarkets forces them to reduce investment costs, continuous energy costs and the cost of maintenance. The planning concept, the costs and the savings targets, as well as the use of waste heat from small refrigeration systems are reported on. There are some preliminary remarks on the purposes of domestic engineering in department stores and supermarkets. Details are given of the outside air rates for sales floors. The investment and running costs of the heat supply requirement, transmission heat requirement and electrical power of a ventilation system for a supermarket are listed. In the second example - a department store - the costs listed are for the heating requirement, and energy required for driving the ventilators and refrigeration machinery. Remarks on the potential for heat recovery from small refrigeration systems are made at the end. Cost savings are possible by means of restricting the amount of outside air taken into rooms, and heat recovery.

11432 (CONF-8411226—Trans., pp 447-476) **Balance-sheet of a large-scale heat pump system for heating a residential complex.** Grunenberg, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

To assure economical heating supplies in the long term for an old people's nursing home (floor space: 10800 m^2), a monovalent gas heat pump system was installed. The natural gas is burnt in a 6-cylinder motor in line (115 kW nominal output). The exhaust gases are cooled down in a heat exchanger, in which the heat is transmitted to the heating-water. A screw compressor compresses the cooling medium, which is then liquefied in the condenser, during which a heat output of 434 kW is given off to the heating-water. The cooling medium is then tension-released and evaporated, during which 319 kW heat is extracted from the well-water in the evaporator. The heat output of the system as a whole is 630 kW. Remarks on peculiarities of the system (ground water heat source, 3-well system needed) are made. Specifications and planning objectives are named and operational results recorded in comprehensive tables (water and heat quantities). A cost efficiency calculation (negative capital values) showed that the system is not functioning

economically as yet; the losses of the first few years of operation will have to be made up out of public funds.

11433 (CONF-8411226—Trans., pp 477-494) **Modernisation of the energy engineering in large buildings, as in the example of Freiburg University.** Reinmuth, F. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

Systematic studies of energy engineering as described for the example of Freiburg University, are the apparently most worthwhile and necessary preliminary stage towards saving energy in existing buildings. Only they will provide the necessary catalogue of measures to be taken and the economic justification for the sequence of economy investments. They supply the guideline for management decisions for the subsequent years. By menas of such studies, loss of investments or those that result in a less efficient cost/benefit account when better alternatives would have been available, can be avoided. The fee for an engineer for such a qualified expert study as described here, appears negligible by comparison.

11434 (CONF-8411226—Trans., pp 495-524) **Influence of the way the process is carried out on the economic efficiency of indoor air conditioning equipment - a practice report.** Esdorn, H.; Jahn, A. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

Examples from practical experience show that important savings in energy costs for indoor air-conditioning machinery are only possible through changes in the way the process is managed. The function sequences for the regulation are so convoluted that it is hardly possible to make a reliable assessment of annual consumption based on various momentary states. Computer simulation with copies of all the control and regulatory function processes proves to be a good method of finding a solution to these tasks.

11435 (CONF-8411226—Trans., pp 525-543) **Improvement of operational behaviour of a heating system equipped with a water/air source heat pump.** Gruhle, W.D.; Isermann, R. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

Tests were carried out over a 4-year period to improve the performance of a bivalent heating system (electrical air-water source heat pump), especially the control functions. First there is a closer description of the original heating system (wiring diagram) and its operational results, going on to give information on further operational results for the subsequent heating periods, during which improvements were made to the control system and intermediate storage was introduced. In the following two heating periods, a timer-controlled link storage unit was used in addition and the external wall insulation was improved. By means of the individual measures mentioned, it was possible to decisively improve the heat pump characteristics (number of heat pumps, performance). In assessing the economic efficiency, the bivalent heat pump system under examination was compared to a monovalent boiler system. Economically positive results can only be achieved, however, if the energy savings can compensate for the extra costs for the heat pump, storage equipment, control, installation and maintenance in the course of time.

11436 (CONF-8411226—Trans., pp 545-568) **Structure of the plant and results of measurement of energy requirement for the supply of heat and cold to the administration building at Thyssengas in Duisburg.** Boettcher, C.; Brammer, D. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

In a newly-built office building, a gas-engined heat pump system was planned in addition to various energy-economy types of engineering. It was to supply both cooling and heat together all year round and included cold and hot water storage. The results gained from measurements taken during operation from this combined system of gas engine, heat pump and gas boiler were compared with those from piston-cold water sets and gas boiler. System data for heat and cold generators are named in connection with a wiring diagram and the special arrangement of the cold- and heat-pump system is shown. Temperature variations in the cold and heating-water feed pipe and the charging of the storage units are gone into. A comprehensive table lists the consumption figures for the system installed and the system used to compare it for different outside air conditions. From the values listed in the tables and the explanations given on them, it is seen that energy savings of up to 20.6% were attainable using the system installed, as were investment cost savings of up to 12.5% by comparison with the competing system.

11437 (CONF-8411226—Trans., pp 609-626) **Balance sheet of success for energy saving schemes in industry.** Lautner, R. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

A number of schemes for saving energy in industry are presented. A heating power station was erected for the assembly plant of a car manufacturer to deal with the peak load whilst at the same time using remote heating for the basic supply. The second scheme concerned heat recovery in the air-treatment system of a factory supplying the car industry (1600 t heating oil savings), whilst a third project was an ironmongery factory in a desert climate (max. temperatures up to +50°C and in Winter as low as -10°C; air conditioning for working areas). Further energy savings were achieved by means of rotating heat exchangers in paint spraying equipment (heat recovery instead of pre-heating). More accurate explanations from the thermotechnical point of view, involving wiring diagrams and sketches of the type of indoor spaces concerned, energy cost diagrams and graphical system representations, are given.

11438 (CONF-8411226—Trans., pp 639-661) **Energy savings and building technology.** Apel, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

For the planner of technical equipment for buildings, energy economy is one of the main objectives alongside safety and cost efficiency. In the field of technology in buildings, energy saving means above all drawing up a rationalised energy concept with consideration for all energy-relevant factors, an overall view and integrated planning. As well as the most modern or alternative technologies, the so-called 'normal techniques' should not be left out. The use of energy-saving, energy-recovering or energy recycling systems and components should also be weighed up. The regulation, controls, monitoring and maintenance of the system can also contribute towards economic running energy-wise.

11439 (CONF-8411226—Trans., pp 663-696) **Cogeneration units and heat pumps for public swimming pools - a report on practical experience.** Moog, W. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

Possible ways of saving energy are illustrated with the example of 3 swimming pools, one typical indoor pool, an indoor pool with various special attractions and an all-weather open-air pool, and one all-weather open-air swimming pool. The success in practice is compared with forecasts. Before cost-cutting measures were developed, analysis were done of the present state of the project (building physics analysis; analysis of heat generation, heat application systems, indoor HVAC systems, electrical power consumption, the efficiency profile, water technology). For the planning basis, the following calculations were made: heat requirement determination, cooling load, dimensioning of air pipes, and determining the amount of overspill water. A number of mathematical models were adduced to test how much investment would be needed for the proposed energy saving measures and the test results were listed in comprehensive tables. By means of the heat pump systems put into

use as described in detail, considerable improvements in the operating cost structure were able to be achieved (numerical details in tables and diagrams).

11440 (CONF-8411226—Trans., pp 717-733) **Air-fed evaporators and condensing units.** Schmitz, U. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

The three tasks of an air cooler are explained in more detail by means of a principle sketch, characteristics and tabular data. Space cooling is explained first, with remarks on temperature values, artificial defrosting (electric heating elements, hot gas, additional liquid circuits in the cooling system, water defrosting sprinklers, defrosting cycles, evaporator output, cooling period and over-dimensioning). Then, air circulation is dealt with, giving details of air flow control, suction process, pressure evaporators, air movements within the space, and air velocity in the evaporator. The third task of the air cooler consists in the extraction of humidity. A diagrammatic representation of the connections between temperature difference and humidity extraction is given. The author goes into overheating, normal performance of the ventilator air cooler, frost layer formation, low-load slatted pipe systems and defroster heating. There are also details of the condenser unit. An axial ventilator and condenser and a 'dual-benefit' condenser. The characteristics in terms of air conditioning of axial and radial ventilators and the types of use they can best be put to are summed up in table form. Finally, some corrosion problems in air-coolers and condensers are mentioned and prevention measures are named.

11441 (CONF-8411226—Trans., pp 751-762) **Micro-computer control VS 1000.** Kriewald, B. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

A computerised control system was used in order to reduce the costs of energy and maintenance, of a refrigeration system, especially, when used in a compound system. An overview of design and functional characteristics of this microcomputer control is given. By operating a parameter key the internal parameter list can be accessed. The following parameters can be selected: Number of compressors and output levels per compressor; Number of condenser ventilators; Temperatures (pressure tube, oil, limit value); pressures (limit value, suction pressure, high pressure); shortage of cooling medium; Cycle time for base load changeover; times for compulsory switch-on of cold consuming equipment, low-pressure and high-pressure control. More details are given on these parameters, their significance and functional effects. Performance characteristics of the system are named, as are the component units of the central unit.

11442 (CONF-8510218—3) **Data acquisition and testing at the Tennessee Energy Conservation in Housing (TECH) complex.** Baxter, V.D. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005026.

From Field data acquisition for building and equipment energy-use monitoring national workshop; Dallas, TX, USA (16 Oct 1985).

The Tennessee Energy Conservation in Housing (TECH) complex was built in 1976 and includes five test residences. It has been used to compare the performance of novel heating, air conditioning, and water heating systems to that of conventional systems. Systems tested include the annual cycle energy system (ACES), solar systems, and ground-coupled heat pumps (GCHP) with conventional air-source heat pumps (ASHP) as control systems. A single Hewlett-Packard minicomputer-based data acquisition system (DAS) serves all five structures. Design of the DAS hardware and software was driven by the long term (annual) test requirements of the ACES and solar systems. The system was set up to scan on a once-per-hour, 24 h/day basis and utilized integrating instrumentation for energy consumption and delivery. Measurement of seasonal and annual performance factors was the primary goal. More recently the TECH complex and DAS were used to obtain detailed field data on dynamic losses for an ASHP. While the DAS performed adequately, it is felt that the software could have been tailored better for this purpose. However, since the DAS was being used concurrently to provide seasonal performance for GCHP systems, this was not possible.

11443 (DOE/CS/20524—7) **Affordable manufactured housing through energy conservation. A guide to designing and constructing energy efficient manufactured homes.** (Winter (Steven) Associates, Inc., New York (USA)). Jul 1984. Contract AC01-79CS20524. 116p. NTIS, PC A06/MF A01 - GPO; GPO Dep. File Number DE86005072.

A guide to help new homebuyers in designing and constructing energy efficient manufactured homes is presented. The information provided includes: ceiling, wall and floor insulation; air infiltration; windows; shading; movable insulation; equipment; and fans. Selection of energy conservation options is also discussed, including: space conditioning, domestic hot water, and appliances. Some economics of the options are also discussed. (BCS)

11444 (DOE/MA—0196) **Ten-Year Inhouse Energy Management Plan.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Project and Facilities Management). Oct 1985. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005145.

This document is the FY 1985 update of the Department of Energy (DOE) Ten-Year Energy Management Plan covering the period of FY 1986 to FY 1995: It combines the formerly separate Ten-Year Buildings Plan and Ten-Year General Operations Plan to provide a coherent, total approach to energy management for DOE owned and leased buildings and facilities, and vehicles and equipment.

11445 (DOE/R1/10004—T1) **Dimetrodon performance summary: energy systems and the evolution of an ecological community design process.** (Dimetrodon Research Station, Warren, VT (USA)). 30 Jun 1981. Contract FG41-79R110004. 41p. NTIS, PC A03. File Number DE86000353.

This final report documents the process utilized to fulfill the requirements of the grant award, evaluates the performance of the integrated energy systems at Dimetrodon, and is intended to serve as a guide to other individuals or groups undertaking such community projects utilizing integrated renewable energy systems in an ecological context. The work covered in the grant includes the construction of a 1000 square foot site-built Solaroll solar collector; the erection of a 70 foot tower for a previously purchased 32 volt 1800 watt Jacobs wind generator and the installation of a monitoring system. Data collection has indicated that 75% of all energy consumed at Dimetrodon comes from renewable energy sources and 17% from direct solar sources. In a six month period, 50% of all domestic hot water needs have been supplied by solar energy, despite lower than predicted performance of the collector and losses from a gas domestic hot water tank. This translates to gas savings for domestic hot water of 272 gallons per year or $265 per year at our present cost of $.976 per gallon. Total savings from the active collector is over five cords of wood per year, or 550 gallons per year at an average savings of $475 per year. This corresponds to an eighteen year direct payback, not counting fuel inflation rates, cost of money or inflation.

11446 (EPRI-EM—4217) **Heat exchanger requirements for potable water protection. Final report.** Marciniak, T.J.; Kuhaneck, D.P.; Sharon, A. (Fauske and Associates, Inc., Burr Ridge, IL (USA)). Dec 1985. 130p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920100.

The initial cost and performance of heat pump water heaters, water source heat pumps, heat reclaim desuperheaters and condensers can be adversely affected by plumbing and mechanical codes which require double-wall separation between refrigerants and potable water. This requirement exists in several the national model building codes, city and state codes, and product standards. The requirement, which may not be justified, can limit the economic market for these technologies and deprive some electric utilities and their customers of energy conservation and load-leveling benefits. This report reviews the current status of building, plumbing and

mechanical codes, equipment design and testing standards, and the technical basis for double-wall separation between refrigeration and potable water systems. Included is an analysis of the health and safety issues associated with refrigerants and compressor oil contamination of potable water, and an evaluation of performance and cost impacts. Results indicate a lack of uniformity in code and standard requirements nationwide and little technical basis for requiring double-wall separation. Initial equipment costs can be increased from 8 to 40%. Recommendations are included for (1) developing a technical basis to support code language changes, (2) modifying present code language to be more flexible, and (3) establishing a mechanism for code changes.

11447 **(ORNL/Sub—79-24610/4) Development of a residential gas fired absorption heat pump. Physical and thermodynamic properties of R123A/ETFE system development and testing economic analysis. Final report.** Murphy, K.; Simon, R.; Phillips, B.; Marsala, J.; Whitlow, E. (Allied Corp., Morristown, NJ (USA); Phillips Engineering Co., St. Joseph, MI (USA)). Aug 1985. Contract AC05-84OR21400. 215p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86004588.

This report covers the development work on the R123a/ETFE (ethyltetrahydro furfuryl ether) pair and an economic analysis of the system. Extensive thermodynamic and physical properties of the R123a/ETFE system were developed. Theoretical analysis of the data was made and showed very good performance. Subsequent testings on equipment not fully developed for R123a/ETFE confirmed this very good performance. The economic analysis showed the system competitive in most areas of the US if improved performance goals (COP = 1.5) can be met. The most important factors in determining the competitiveness are heating to cooling ratios and the relative cost of gas and electric.

11448 **(ORNL/Sub—79-42539/5) Calibrated hot box test results data manual. Volume II. Final report.** Van Geem, M.G.; Larson, S.C. (Construction Technology Labs., Skokie, IL (USA)). Aug 1985. Contract AC05-84OR21400. 168p. NTIS, PC A08/MF A01; GPO Dep. File Number DE86005259.

This manual summarizes results of two reference "standard" walls, two masonry cavity walls, a concrete wall with insulation board, and a wood frame wall tested in CTL's calibrated hot box. A description of wall geometry and material properties is given for each specimen. The manual presents steady-state, transient, and dynamic (periodic) test results in tabular form, in figures, and in summary tables. Heat transfer characteristics of different wall assemblies can be compared by using figures and summary tables for each wall. Data presented in numerical form can be used to validate models or further analyze results.

11449 **(PNL-SA—13144) Envelope design implications of ASHRAE Standard 90.1P: a case study view.** Crawley, D.B.; Briggs, R.S. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1985. Contract AC06-76RL01830. 28p. (CONF-851202—4). NTIS, PC A03/MF A01; GPO Dep. File Number DE86004865.

From DOE-ORNL-ASHRAE-BTECC conference on thermal performance of the exterior envelopes of buildings-III; Clearwater Beach, FL, USA (2 Dec 1985).

ASHRAE recently issued a public review draft of Standard 90.1P, Energy Efficient Design of New Non-Residential Buildings and High-Rise Residential Buildings. The revisions proposed in Standard 90.1P are substantially different in structure and content from the existing Standard, especially those sections dealing with building envelope. In this paper, the envelope requirements of Standard 90.1P and their impacts on envelope design features are demonstrated. Several example buildings and locations are used to convey the underlying concepts and nature of the envelope criteria and the implications of those concepts for a variety of envelope attributes.

11450 **Energy sources: conservation and renewables.** Hafemeister, D.; Kelly, H.; Levi, B. (eds.). New York, NY; American Institute of Physics (1985). 679p. (CONF-850414—). American Institute of Physics, 335 East 45th St., New York, NY 10017 $55.00.

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

The physics community conducted a summer study at Princeton University on the efficient use of energy during the summer of 1974; the AIP book containing this study (AIP 25, 1975) has been the largest selling AIP Conferences Series book to date. The subject 1985 AIP conference proceedings is published under the following headings: technical progress and policy options (5 chapters); energy and buildings (7 chapters), windows, lighting, appliances, and HVAC (5 chapters); industrial and automotive (2 chapters), and electricity and renewables (9 chapters). Also, 10 appendices relevant to the subject are included. A separate abstract was prepared for each of the 28 chapters for the Energy Data Base (EDB); 10 are included in Energy Research Abstracts (ERA) and 21 in Energy Abstracts for Policy Analysis (EAPA).

11451 **Residential energy efficiency: progress since 1973 and future potential.** Rosenfeld, A.H. (Lawrence Berkeley Lab., CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 135, 92-121(1985). (CONF-850414—).

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

Today's 85 million US homes use $100 billion of fuel and electricity ($1150/home) annually. If their energy intensity (resource energy/ft^2) were still frozen at 1973 levels, they would use 19% more. With well-insulated houses, need for space heat is vanishing. Superinsulated Saskatchewan homes spend annually only $270 for space heat, $150 for water heat, and $400 for appliances, yet they cost only $2000 +/- $1000 more than conventional new homes. The concept of Cost of Conserved Energy (CCE) is used to rank conservation technologies for existing and new homes and appliances, and to develop supply curves of conserved energy and a least cost scenario. Calculations are calibrated with the BECA and other data bases. By limiting investments in efficiency to those whose CCE is less than current fuel and electricity prices, the potential residential plus commercial energy use in 2000 AD drops to half of that estimated by DOE, and the number of power plants needed drops by 200. For the whole buildings sector, potential savings by 2000 are 8 Mbod (worth $50B/year), at an average CCE of $10/barrel. 6 references, 17 figures, 2 tables.

11452 **Energy conservation in large buildings.** Rosenfeld, A.; Hafemeister, D. (Lawrence Berkeley Lab., CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 135, 148-168(1985). (CONF-850414—).

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

As energy prices rise, newly energy-aware designers use better tools and technology to create energy-efficient buildings. Thus the US office stock (average age 20 years) uses 250 kBTU/ft^2 of resource energy, but the guzzler of 1972 uses 500 (up x 2), and the 1986 ASHRAE standards call for 100-125 (less than 25% of their 1972 ancestors). Surprisingly, the first real cost of these efficient buildings has not risen since 1972. Scaling laws are used to calculate heat gains and losses of buildings to obtain the ΔT(free) which can be as large as 15-30°C (30-60°F) for large buildings. The net thermal demand and thermal time constants are determined for the Swedish Thermodeck buildings which need essentially no heat in the winter and no chillers in summer. The BECA and other data bases for large buildings are discussed. Off-peak cooling for large buildings is analyzed in terms of saving peak-electrical power. By downsizing chillers and using cheaper, off-peak power, cost-effective thermal storage in new commercial buildings can reduce US peak power demands by 10-20 GW in 15 years. A further potential of about 40 GW is available from adopting partial thermal storage and more efficient air conditioners in existing buildings. 9 references, 13 figures.

11453 **Energy and lighting.** Berman, S. (Lawrence Berkeley Lab., CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 135, 247-257(1985). (CONF-850414—). Contract AC03-76SF00098.

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

Advances in research for new types of lighting with increased efficacies (lumens/watt) are discussed in the following

areas: (1) high-frequency, solid-state ballasts, (2) isotopic enhancement of mercury isotopes, (3) magnetic augmentation, (4) electrodeless, ultra-high frequency, (5) tuned phosphors, (6) two-photon phosphors, (7) heat mirrors, and (3) advanced control circuits to take advantage of daylight and occupancy. As of 1985, improvements in efficacy have been accomplished on an economic basis to save energy for (1) high-frequency ballasts (25%), (2) isotopic enhancement (5%), and (8) advanced control circuits (up to 50%). Most of these advances depend on a deeper understanding of the weakly ionized plasma as a radiating and diffusing medium. 3 figures, 4 tables.

11454 **Window performance and building energy use: some technical options for increasing energy efficiency.** Selkowitz, S. (Lawrence Berkeley Lab., CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 135, 258-269(1985). (CONF-850414—). Contract AC03-76SF00098.

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

Window system design and operation has a major impact on energy use in buildings as well as on occupants' thermal and visual comfort. Window performance will be a function of optical and thermal properties, window management strategies, climate and orientation, and building type and occupancy. In residences, heat loss control is a primary concern, followed by sun control in more southerly climates. In commercial buildings, the daylight provided by windows may be the major energy benefits but solar gain must be controlled so that increased cooling loads do not exceed daylighting savings. Reductions in peak electrical demand and HVAC system size may also be possible in well-designed daylighting buildings. 10 figures.

11455 **Economics of efficiency improvements in residential appliances and space conditioning equipment.** Levine, M.D.; Koomey, J.; Ruderman, H.; Craig, P.; McMahon, J.; Chan, P. (Univ. of California, Berkeley). *AIP (American Institute of Physics) Conference Proceedings;* No. 135, 299-322(1985). (CONF-850414—).

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

The authors examine eight major residential appliances in the US that currently consume 8.9 quads/year, representing more than 12% of total 1984 US energy use. Expenditures on energy for these appliances totaled over $56 billion in 1984. Results indicate that improving the efficiency of all these appliances to economically optimal levels would reduce these annual expenditures by almost 30%, a savings of $17 billion per year. In steady state, the annualized additional investment cost to achieve this efficiency improvement is $7 billion, so the net savings is about $10 billion per year. This paper describes and analyzes energy efficiency choices for residential appliances and space conditioning equipment. The first section briefly illustrates historical trends in the average efficiencies of new appliances sold in the United States during the last decade. The second section shows results of the life-cycle cost analysis of eight major residential appliances. Results provide striking evidence that the market is not achieving economically optimal efficiency levels. 7 references, 5 figures, 8 tables.

11456 **Vapor-compression heat pump system field tests at the TECH complex.** Baxter, V.D. (Oak Ridge National Lab., TN). *AIP (American Institute of Physics) Conference Proceedings;* No. 135, 323-346(1985). (CONF-850414—). Contract AC05-84OR21400.

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

The Tennessee Energy Conservation in Housing (TECH) complex has been utilized since 1977 as a field test site for several novel and conventional heat pump systems for space conditioning and water heating. Systems tested include the Annual Cycle Energy System (ACES), solar assisted heat pumps (SAHP) both parallel and series, two conventional air-to-air heat pumps, an air-to-air heat pump with desuperheater water heater, and horizontal coil and multiple shallow vertical coil ground-coupled heat pumps (GCHP). A direct comparison of the measured annual performance of the test systems was not possible. However, a cursory examination revealed that the ACES had the best performance, however, its high cost makes it unlikely that it will achieve wide-spread use. Costs for the SAHP systems are similar to those of the ACES, but their performance is not as good. Integration of water heating and space conditioning functions with a desuperheater yielded significant efficiency improvement at modest cost. The GCHP systems performed much better for heating than for cooling and may well be the most efficient alternative for residences in cold climates. 27 references, 12 figures, 9 tables.

3202 Transportation

REFER ALSO TO CITATION(S) 11411, 11411, 11488, 11496, 11497

11457 **(AD-A—158514/0/XAB) Small-turbine technology review. Final report, February-December 1984.** Oelrich, I.C.; Weidhuner, D.D.; Riddell, F.R. (Institute for Defense Analyses, Alexandria, VA (USA)). Jul 1985. 91p. (IDA-P—1840). NTIS, PC A05/MF A01.

This study, for OUSDRE (Research and Advanced Technology, Military Systems Technology), examines the nature of the small gas turbine development process for military applications, attempts to identify gaps between current programs and probable future needs, and makes program recommendations for acquiring desirable new turbine technology. Small turbines are found to fall into one of four categories: man-rated, expendable, auxiliary power, and ground vehicle engines. The technical requirements of each category are reviewed and possible R&D opportunities identified.

11458 **(DOE/ER/30063—T1-Vol.1) Advanced propulsion systems and alternative fuels for non-highway transportation. Volume I. An assessment of unique and priority research and development opportunities. Final report.** (Mueller Associates, Inc., Baltimore, MD (USA)). Sep 1985. Contract AC01-84ER30063. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86002973.

This report is Volume I of a three-volume set documenting an assessment of unique and priority research and development opportunities associated with advanced propulsion systems and alternative fuels utilization for non-highway transportation applications. The air, rail, marine, and pipeline modes of transportation were addressed. More specifically, the scope of the study was focused upon advanced fuel-powered prime movers which are or could be applied to aircraft, locomotives, boats/ships, and pipeline pumping/compression station applications. Of note is the fact that advanced electric powered propulsion technologies were not addressed. (This is principally an issue for the rail and pipeline modes.) This report (Volume I) presents the assessments and recommendations resulting from the study as well as supporting information and background discussions.

11459 **(DOE/ER/30063—T2-Vol.2-App.) Advanced propulsion systems and alternative fuels for non-highway transportation. An assessment of unique and priority research and development opportunities. Volume II. Appendices. Final report.** (Mueller Associates, Inc., Baltimore, MD (USA)). Sep 1985. Contract AC01-84ER30063. 132p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86002974.

This report is Volume II of a three-volume set documenting an assessment of unique and priority research and development opportunities associated with advanced propulsion systems and alternative fuels utilization for non-highway transportation applications. The air, rail, marine, and pipeline modes of transportation were addressed. More specifically, the scope of the study was focused upon advanced fuel-powered prime movers which are or could be applied to aircraft, locomotives, boats/ships, and pipeline pumping/compression station applications. Of note is the fact that advanced electric powered propulsion technologies were not addressed. (This is principally an issue for the rail and pipeline modes.) This report (Volume II) consists of report appendices which provide details to the study methodology, workshop, and final assessments.

11460 (DOE/ER/30063—T3-Vol.3) Advanced propulsion systems and alternative fuels for non-highway transportation. An assessment of unique and priority research and development opportunities. Volume III. A compendium of research and development. Final report. (Mueller Associates, Inc., Baltimore, MD (USA)). Sep 1985. Contract AC01-84ER30063. 166p. NTIS, PC A08/MF A01; GPO Dep. File Number DE86002975.

This report documents the combined results of a literature search and personal communications activity designed to identify on-going R and D and suggested R and D needs for advanced propulsion systems and alternative fuels utilization technologies for non-highway transportation applications. The results are presented in the three subsequent chapters of this report. Section 3 presents the results of the literature search. Some of the information reported in Section 3 was obtained through communications with and information received from various Government and private R and D funding entities. Each identified R an D program or project is summarized and various additional information deemed pertinent is noted. Section 4 presents the results of discussions and communications with various private organizations and academic institutions. These discussions and communications were designed to buttress the literature search effort and were conducted independently of the literature search. Thus, some cross-reporting of research efforts will exist. Section 5 presents the results of personal communications with selected key researchers. This latter activity was designed to elicit recommendations of R and D needs, thus providing the workshop panel with additional advance information for its considerations as well as to provide additional input for the final assessments reported in Volume I.

11461 (DOE/PE/77000—1) Motor Fuel Consumption model. Twelfth periodical report. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Nov 1985. Contract AC01-85PE77000. 144p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86000564.

This document is the twelfth of a series of periodic reports on the Motor Fuel Consumption (MFC) model developed for the Department of Energy (DOE), Office of Policy Integration, Office of Policy, Planning and Analysis. The MFC model is used by DOE to evaluate the impact of conservation policies on fuel consumption and on the disaggregate components of fuel demand. These components include passenger cars, light-duty trucks, and heavy-duty vehicles. The model is not a forecasting tool in that it does not provide detailed econometrically-based projections of fuel demand. The model is, however, calibrated to current statistics on fuel consumption. fleet size, and travel growth, and to econometric forecasts of new vehicle sales provided by DOE. During the past year (November 1984 to October 1985), the MFC model has been used to evaluate the consumption impacts of a reduction in Corporate Average Fuel Economy (CAFE) standards for model year (MY) 1986 passenger cars. To facilitate analyses of the potential development and expansion of a market for alcohol fuels in transportation, the model has been reconfigured to include neat methanol, ethanol/gasoline blend, and methanol/gasoline blend components. In addition, as part of an overall effort by the sponsor to transfer DOE analytical models onto micro-computers, a version of the MFC model was developed for operation on an IBM Personal Computer (PC/XT). The purpose of this report is to provide the reader with the most current output of the Motor Fuel Consumption Model and to discuss revisions in the model structure, input data and assumptions which have occurred in the past year. 46 refs., 3 figs., 26 tabs.

11462 (ORNL/TM—9847) Study of current and planned high occupancy vehicle lane use: performance and prospects. Southworth, F.; Westbrook, F. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86004660.

This report details the results of a nationwide study of HOV lanes: their characteristics and performance as traffic congestion mitigating and rideshare enhancing facilities. The study took the form of telephone interviews with a variety of planning agencies in each of the 48 contiguous states and Hawaii over the period April through June 1985, with subsequent receipt of the most current documentation on regional HOV lane operations. The most up-to-date evidence on each lane's performance is presented: its hourly and peak period person throughput vis-a-vis the highway's adjacent, conventional mixed traffic lane(s), its vehicle throughput and occupancy, travel speed and travel time savings for HOVs, lane rule violation rates, lane construction and maintenance costs and accident data. Estimates are provided of the growth in ridesharing over the life of the HOV-only lanes, of the number of vehicles removed from the highway through ridesharing, and of the subsequent fuel savings attributable to HOV lane projects. The relationship between bus patronage and carpool/vanpool mode adoption is looked at, and it is concluded that both forms of HOV can do well on properly planned lanes. The authors also point out the very partial nature of the existing evidence upon which to base HOV lane project evaluation, and the subsequent difficulty associated with "selling" the HOV lane concept to many planners and members of the public. They identify those characteristics associated with clearly successful HOV lane projects. Finally, the current state of planning for new HOV lanes in cities around the nation is described, and the major reasons given for rejection or abandonment of HOV lane projects are discussed.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 11116, 11117, 11128, 11195, 11413, 11421, 11437, 11445, 11453, 11456, 11484

11463 (CONF-8410367—) Agricultural technology. (Verein Deutscher Ingenieure (VDI), Duesseldorf (Germany, F.R.). Fachgruppe Landtechnik). 1984. 145p. (In German and English). NTIS (US Sales Only), PC A07/MF A01. File Number DE86770072.

From 42. international meeting on agricultural technology; Neu-Ulm, F.R. Germany (25 Oct 1984).

This conference report contains abridged versions of 58 papers given at the 'Agricultural Technology' conference from October 25th-26th 1984 in Neu-Ulm. Among others, the following subject areas were treated: the use of micro-electronics in agriculture; alternative fuels for agricultural machinery; thermal insulation in greenhouses. A separate summary of contents has been made for each of 7 out of the 58 papers.

11464 (CONF-8411226—Trans., pp 201-217) Screw compressors in the food industry. Lindborg, A. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

Screw compressors are fully acknowledged in the food industry of today. A host of improvements have been made since they were introduced. Most of these were described in detail in earlier literature. This is a discussion of three fundamentally different ways of cooling compressor oil; with water-cooling, by means of direct injection of the cooling medium or cooling medium condensate in a special heat exchanger. Experience has shown that the equipment has 15% too little capacity. The reason for this is unrealistic catalogue data for compressors with direct injection.

11465 (CONF-8411226—Trans., pp 231-247) Controlling a cooling medium evaporator with an electrically-driven injection valve. Gruhle, W.D. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

This article shows that it is possible to achieve good control of heating even under variable conditions for use, by putting in an electrically driven injection valve and an external digital adjustment system, which had been put into practice on a computer for experimental purposes, instead of using a thermic expansion valve. An increase in the performance coefficient demonstrates that improved evaporator output can actually lead to an economically more efficient way of working. Closer attention is given to the analysis of the evaporation adjustment route (thermodynamic change of state) and proposed design for such a control system (equation of a PID-regulator, disturbance variable switching, cascade system). The author goes into control sequences under different marginal condi-

tions and deals with the scientific assessment of results (comparison of relationship between thermostatic expansion valves and electrically-driven injection valves). He succeeded in proving that overheating in a cooling medium evaporator can be controlled at a low level by using an electrically driven injection valve with improved adjustment control. The functioning capcaity of this system was studied under various marginal and disturbance conditions.

11466 (CONF-8411226—Trans., pp 277-295) **Use of ice storage equipment in the food industry.** Vries, H. de. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

The manufacture of foods in its widest sense demands a 'balanced supply of cooling'. Whenever 'cold requirement' occurs in different ways during production, the ice storage equipment in particular for 'cooling supplies'. The cooling performance (amount of cold from horizontal tubes and slabs or from horizontal pipes given off to the water flowing past) that can be expected from modern ice storage equipment, is made clear numerically. The way the storage vessel is constructed and its design have particular influence on the energy-saving quality (stirring mechanism with high performance at low pump capacity). Optimisation results for a plate evaporator design combined with a heat exchange system are presented. These include running cost savings of up to 18% in a yoghurt factory, a maltery and an ice cream factory. By means of this heat pump compound, environmental energy can be used in cold storage.

11467 (CONF-8411226—Trans., pp 341-354) **Refrigerated foods in bulk containers - influence of the way processing is done on the microbiological stability of instant dishes.** Fischer-Ayloff-Cook, K.P. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

Whereas sterilised and deep-frozen foods can be kept for long periods, foods capable of being reconstituted that are preserved by cooling to temperatures only slightly above freezing point are known as refrigerated foods. The main advantages of using refrigerated foods are seen in the better utilisation of investments in the technical equipment for kitchens, the lower energy requirement by comparison with deep-frozen foods, smaller external food serving units can be supplied more rationally, and quality advantages over other types of preservation. A report is given on microbiological testing on 5 different refrigeration processes. These are air cooling with forced convection; swilling the containers in water/brine; spraying with CO_2 snow; CO_2 convection cooling; contact cooling with CO_2 snow. Only packaged foods were cooled (five product categories described in detail). The tests showed that CO_2 contact cooling produced the shortest experimental times, but large areas of the product were frozen through due to the extremely low temperatures. A diagrammatic summary recorded the thicknesses of the product layers at cooling times of up to 300 minutes with air and water cooling.

11468 (CONF-8411226—Trans., pp 355-364) **Influence of the cooling process on the sensory characteristics of fresh meat.** Woltersdorf, W. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

Rapid temperature reduction for freshly-slaughtered animal carcasses or the meat from them is the best protection against the reproduction of microorganisms. Rapid temperature reduction increases durability in this way; moreover, these cold temperatures reduce the cooling-down times and the loss of substance in the meat which occurs due to water evaporation. The disadvantage of this rapid deep-freezing is the phenomenon of cold shortening (c.s.), an irreversible shortening effect on muscle fibres which results in toughness in the deep-frozen meat. For this reason a study has been made as to which sections of beef carcasses suffered c.s. at what freezing speed. Individual details of the testing procedure and characteristics studied (Temperature curve, ATP-content, pH value, tenderness, firmness, length of muscle fibrils, length of muscle) are given. The time-dependent freezing temperature curve of various sorts of beef was recorded in diagrams. Remarks are made on the way in which c.s. occurs and recommendations on how to prevent it are given. It was found that electrostimulation did not produce any extra tenderness effect when no c.s. is present.

11469 (CONF-8411226—Trans., pp 365-392) **Roundtable discussion: -18°C in the food industry.** Vollmer, A. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

10 experts from deep-freeze engineering, the food industry, nutrition science and the media discuss keeping to -18°C for transport and storage of frozen foods and worries caused by temperature deviations leading to influences on the quality of the frozen foods. As an introduction, a reminder is given that this -18°C level was fixed arbitrarily, as deep freezing of food originated in America, where -18°C corresponds to 0°Fahrenheit. The opinion was that the question of temperature has to represent a compromise between quality, costs and feasibility in the freezing chain. The question was whether increasing the input of energy costs really results in such an increase in quality that the consumer is aware of it. In many cases, -12°C would be quite adequate (e.g. poultry). The questions touched on were than spotlighted more closely from the point of view of the low relating to food, the public (traders, consumers) and the manufacturers of refrigeration equipment. Finally, the conclusion was that the idea was not to reduce the -18°C limit to -12°C, but to admit a freezer temperature tolerance range (problems for transport inspections for frozen foods).

11470 (CONF-8411226—Trans., pp 405-424) **Optimisation of large-scale industrial refrigeration.** Guettler, G. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

This is a report on the optimisation of the refrigeration supply in an industrial plant using a computer. The measures, part of which have already been taken and part of which are still at the implementation stage, promise a saving on the electricity used for refrigeration of over 10%. This figure must be seen as a great success in view of the fact that the present conventional system is controlled by experienced staff. Further arguments for improving management by means of the computer system are not gone into here (monitoring, recording data, producing management reports, general release of the works technician from routine to make him free for other duties).

11471 (CONF-8411226—Trans., pp 569-608) **Most efficient way of transforming natural gas into heat, cooling and electricity.** Hamkens, J. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

After some introductory considerations of solutions in principle for the economic use of natural gas in industry and global energy planning, closer attention is paid to some of the technologies available today for optimising the use of natural gas. These are the gas-engined heat pump (main components: cold and waste heat circuits), heat pump system in module structure and heat pump system for generating both heat and cold energy at the same time and the block heating/power station (BHPS: Power/Heat Coupling technology; structural diagram). In order to make the running of gas-engined systems kinder on the environment, they work with catalysts and exhaust recovery, higher air surplus or water injection. The following costs are recommended for inclusion in an assessment of economic efficiency: investment, electricity and heat costs, repair and maintenance costs, percentage tax, manning costs. Technical system data for the systems already built are stated (water/water heat pump system with gas engines; water/water or air/water heat pump system with gas engines).

11472 (CONF-8411226—Trans., pp 627-638) **Heat recovery in an air-breakdown system with the use of waste heat for indoor heating and industrial heat.** Truemper, H.; Kipker, R.; Knoche. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

There are about 80 air breakdown works operating in the Federal Republic of Germany for the industrial production of high-quality purified oxygen, nitrogen and Argon from atmospheric air. The plants in general use and of an economically justifiable size have installed performances of 5 to 15 MW. The main cost factor is energy (preferably electric power for driving the compressors). A heat recovery system was installed, because 48% of the compressor energy had hitherto been lost in the warm zone. The hot gas flow in the nitrogen circuit compressor corning out at a temperature of 115°C (block wiring diagram) was used. Comprehensive automatic monitoring and regulating equipment ensures that the heat recovery system does not impair the efficiency of the air breakdown plant and that no other extra sources of trouble detract from operational safety. An illustrated report is given on the distributor unit and the heat exchanger (N_2-circuit compressor) and on the heating oil savings of 26 to 98% during the years when heat recovery was used in 1981 to 1983.

11473 (CONF-8411226—Trans., pp 697-715) **Investigation of air-cooled condensing units with hermetic twin compressors from the point of view of energetics.** Gollnow, K. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

The example of a cold storage room is used to study whether an air-cooled condenser unit with TWIN compressors of the hermetic construction type, whose cooling performance is adjusted to the cooling load and regulated at 2 levels, brings advantages energy-wise over one of equal size with only one hermetically sealed compressor without performance control.

11474 (CONF-8411226—Trans., pp 735-749) **Remote monitoring of refrigeration and air conditioning systems with the air of BBC-York's TELEGUARD system.** Hasekoester, H. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

The aim of operational control of refrigeration and air-conditioning plants is to find out any deviation from normal functioning, to determine what measures are to be adopted and to take steps for correcting any deviation or fault. The TELEGUARD system, developed in the USA and proven in use, was modified for the German market and extended to cover other cases for use. A large number of monitoring and fault criteria are covered; a transfer of measuring values is undertaken. Coded messages are communicated through ordinary telephone lines to a central unit, where they are decoded and fault-correction measures initiated. A detailed explanation of possible uses to which the remote monitoring system can be put, the advantage of using it for operators of refrigeration equipment and heat pumps and the various TELEGUARD system groups is given. This includes the control station, pressure and temperature transmitter, coding, selection and timing module, telephone warning device and receiving station. Remarks on the function process in this system are made. A catalogue of measures sums up the necessary types of information. The cost of remote monitoring has been kept down to a low level by comparison with the investment cost of an electronic monitoring system on-site.

11475 (CONF-8411226—Trans., pp 763-777) **Expansion chambers in the refrigeration circuit.** Goetzenberger, R. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

The cooling medium circulating in a refrigeration circuit must be controlled and dosed in such a way as to make worthwhile use of the relatively expensive evaporator and to protect the compressor. The simplest dosing element could be a nozzle in the liquid output. The capillary tube, used today in refrigeration engineering, is a good control element. However, full exploitation of evaporator and compressor capacity is not possible with a capillary tube. Better results were achieved with automatic expansion valves (especially if the evaporation temperature was strictly observed). Peculiarities regarding the design, performance and use of this type of valve are given. For the control of small, medium and larger systems, the thermostatic expansion valve has asserted itself for a long time now. Absorber filling (good vapourising characteristics), the use of valves with external pressure equalisation, the valve flow conditions and the exchange due to the course of developments of electrically controlled valves for thermostatic ones are dealt with. Remarks are made in conclusion on this kind of electric/hydraulic amplifier with high-temperature conductor in the refrigeration cycle on the suction side.

11476 (DOE/CE/40606—T3) **Ultrafiltration of Kraft Black Liquor. Final report, Phase I.** Hill, M.K. (Maine Univ., Orono (USA)). Oct 1985. Contract AC02-82CE40606. 109p. NTIS, PC A06/MF A01. File Number DE86005233.

Kraft Black Liquor (KBL) is ultrafiltered to favorably affect the properties of the KBL permeate. The major property to be changed is viscosity. If the high molecular weight lignin is removed by ultrafiltration, the KBL permeate should show a significant drop in viscosity. An objective of the work reported was to examine how much KBL viscosity is lowered relative to membrane and membrane pore size used in the ultrafiltration. Another objective was an initial evaluation of ultrafiltration equipment and membranes. Operating characteristics were determined for selected equipment and membranes. Decreases in KBL permeate viscosity were indeed seen. (LEW)

11477 (DOE/ID/12532—1) **Ceramic heat pipe waste heat recovery. Phase I report, August 1, 1984-April 30, 1985.** (Thermo Electron Corp., Waltham, MA (USA)). May 1985. Contract AC07-84ID12532. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86005350.

This report describes design simplifications and mass production concepts that can achieve a heat pipe cost of $448 each. A ceramic heat pipe recuperator design is presented which addresses fouling, cleaning, sealing and maintainability. Overall dimensions including ducts, flanges and insulation are 16 x 5 1/2 x 6 1/2 feet. The weight is 12.5 tons. The simple payback for the system is 0.73 year. A plan for Phase II work is presented, which addresses verification of the concepts developed in the study.

11478 (EPRI-EL—4152-Vol.3) **Optimization of induction motor efficiency. Volume 3. Experimental comparison of three-phase standard motors with Wanlass motors. Final report.** Fuchs, E.F. (Colorado Univ., Boulder (USA). Dept. of Electrical and Computer Engineering). Dec 1985. 374p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920110.

Researchers conducted comprehensive laboratory tests to evaluate the effectiveness of the Wanlass connection in improving motor efficiency. On the basis of these tests, they found no reason to conclude that such a connection is more efficient than the standard connection.

11479 (NYSERDA—85-14) **Energy recovery from existing municipal incinerators. Final report.** (Chesner Engineering, Commack, NY (USA); Black and Veatch, Kansas City, MO (USA)). Nov 1984. 343p. Dept. of Communications, NYSERDA, Two Rockefeller Plaza, Albany, NY 12223. File Number TI86900419.

An inventory of existing municipal incinerator installations in New York State resulted in the selection and evaluation of the feasibility of rehabilitating and retrofitting 14 of the most suitable sites to refuse combustion facilities with electric power generation. The technical evaluation included the definition of incinerator rehabilitation, air pollution control and power generating equipment installation requirements. General arrangement and rehabilitation plans for each facility were prepared and capital and operating cost estimates were projected along with revenues from the sale of electricity to

local utilities. Sensitivity analyses of several economic parameters were undertaken to determine the potential range of break-even costs which could be encountered with heat and worst case conditions. The results of the investigation define the engineering requirements, costs, environmental issues and site-specific recommendations for each facility investigated.

11480 **Batch and column extraction procedures for organics in solid wastes.** Maskarinec, M.P.; Brown, D.K. (Oak Ridge National Laboratory, Oak Ridge, TN). *American Society for Testing and Materials, Special Technical Publication;* **STP-805**: 141-151(Jan 1982). (CONF-820132—).

From ASTM D-34 meeting; Orlando, FL, USA (28 Jan 1982).

Because of the possibility of contamination of aquifers by solid waste leachates, it is important to develop laboratory extraction procedures that predict the release of organic materials from landfills. This paper presents the results of a study comparing five laboratory extraction procedures with respect to the organic content of the extract. Nine solid wastes, representing a wide variety of matrices, were considered. The extraction procedures used were the Environmental Protection Agency Extraction Procedure (EPA-EP), a distilled water extractant, a citrate buffer extractant, a sodium ion-exchange resin extractant, and an upward-flow column extraction test. Organic analysis of the batch extracts was carried out by isolation/concentration of the leachates with XAD-2 resin, followed by gas chromatography on fused silica capillary columns. In the case of the upward-flow column extraction, a cartridge containing XAD-2 was placed directly at the column exit; the resin was isolated/concentrated in a manner identical to the batch extracts. The results were assessed both in terms of total chromatographable organics (TCO) and in terms of the levels of individual compounds. The column technique gave consistently higher results in terms of TCO. This effect is in large measure due toenhanced recovery of highly volatile compounds and nonpolar compounds. The results of the extraction of individual compounds were less consistent. The recovery of carboxylic acids, for example, depended primarily on pH. The recovery of volatile organics, on the other hand, was more closely related to the extraction vessel used than to the extractant. Thus, it may be concluded that the column procedure most aggressively extracted organics from the solid wastes. However, the chemical nature of the organic material in the solid waste determines which of the batch extraction procedures is most aggressive.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 10831, 11122, 11146

11481 (CEER-X—163, pp vp) **Development of design criteria for waste stabilization ponds in the Western Pacific Islands.** Kvandal, S.C.; Barrett, F.H. Jr. 1983. NTIS, PC A99/MF A01. File Number DE86000074. (CONF-8208212—Vol.1).

From 17. conferences of the Pan American Confederation of Engineering Association; San Juan, Puerto Rico (1 Aug 1982).

The need to develop and maintain wastewater collection, treatment, and disposal facilities is of paramount importance to any society. The majority of the tropical islands comprising Micronesia are without adequate wastewater disposal facilities. In many instances no wastewater facilities exist, resulting in uncontrolled discharge of raw wastes to land and water areas. In recent years, mechanical treatment facilities have been constructed and operated in several of the more populated islands, but with limited success. Some of the problems encountered with mechanical systems include special maintenance problems associated with the tropical environment, lack of adequately trained operating personnel, lack of reliable power sources and difficulty in obtaining equipment replacement parts. For these reasons, the use of stabilization ponds has recently been encouraged. Design criteria for construction of stabilization ponds in the Western Pacific differs from that normally employed in the continental US because of the contrasting climatic characteristics. To develop criteria for use throughout the Western Pacific, the performance of an existing stabilization pond facility was evaluated. The facility is located in the Village of Tofol, State of Kosrae, Federated States of Micronesia and is believed to be the only facultative stabilization pond system serving a community throughout Micronesia. The evaluation included an extensive field sampling and analysis program. The results of the evaluation provides insight into various design parameters for use in optimizing the performance of wastewater treatment pond systems throughout the Western Pacific Islands. 13 references, 5 figures, 4 tables.

11482 **(DOE/NBM—6004983) District heating and cooling in the United States: prospects and issues.** (National Research Council, Washington, DC (USA). Committee on District Heating and Cooling). 1985. 166p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86004983.

This report concerns the operation of district heating and cooling (DHC) systems in the United States. Both urban and institutional systems are discussed. The history of DHC is reviewed along with the use of DHC in Europe. (BCS)

11483 **(PB—85-242121/XAB) Investigation of fluid-bed combustion of municipal solid waste.** Eustis, R.H.; Wilson, K.B.; Preuit, L.C.; Marasigan, M.M. (Stanford Univ., CA (USA)). Aug 1985. 88p. NTIS, PC A05/MF A01.

An experimental study was undertaken to burn processed municipal solid waste in a fluid-bed combustor containing water-cooled tubes in the bed. The 300-hour test was performed without incident and terminated on schedule. The combustor and ducting were clean on inspection after the test, and bed agglomeration did not occur. A corrosion tube placed in the free-board showed considerable metal wastage for carbon and low-alloy steels and some wastage for stainless steels. Low-temperature carbon steel water tubes in the bed showed negligible wastage. It was concluded that heat-exchanger tubes in the freeboard require protection from the high-velocity elutriated solids. Combustion efficiency was greater than 99%, and pollutants were measured as follows: SO_2 = 58 ppm, NOx = 178 ppm, CO = 242 ppm, hydrocarbons = 5.4 ppm. A system study was conducted for a cogeneration, 800-tons/day power plant to be located on the Stanford U. campus to supply all of the process steam requirement and as much of the electrical power as possible.

11484 **Mobility of organic and inorganic constituents from energy and combustion-related wastes under codisposal conditions.** Maskarinec, M.P.; Francis, C.W.; Goyert, J.C. (Oak Ridge National Lab., TN). *Materials Research Society Symposia Proceedings;* **43**: 227-235(1985). Contract AC05-84OR21400.

The scenario includes a 95/5 municipal waste/industrial waste ratio. The experimental definition of the leaching rates of various contaminants under the conditions of this scenario was the object of this work. The experimental design included the use of large-scale lysimeters (1.8 M in diameter x 3.6 M height) packed with 1.5 metric tons of municipal waste. A flow rate of ~6.5 l/day of distilled water was added to the lysimeters for the generation of municipal waste leachate (MWL). The MWL was used to leach a variety of industrial wastes, including resource ashes, an API separator sludge/incinerator ash mixture, and a coking plant wastewater treatment sludge. The resulting leachates were analyzed for both inorganic and organic constituents. Inorganic constituents showed two distinct types of leaching behavior. Freely soluble elements (B, Na, Ca, etc.) gave leaching curves that showed exponential declines. Acid-soluble elements (Ni, Zn) eluted as peaks as the pH of the leachate decreased. Organic constituents gave leaching curves dependent on solubility: either an exponential decline (freely soluble compounds) or a relatively flat curve at or near the solubility limit. The availability of this data base has allowed the development of a laboratory extraction procedure for the prediction of contaminant migration in municipal landfills. 6 references, 5 figures, 3 tables.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

11485 (CONF-8410103—) Twenty-second automotive technology development contractors' coordination meeting: proceedings. (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Vehicle and Engine Research and Development). Mar 1985. 526p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015233.

From Automotive technology development contractors' coordination meeting; Dearborn, MI, USA (29 Oct 1984).

Fifty-four papers and reviews are arranged under the following session headings: alcohol fuels; liquid hydrocarbon and gaseous fuels; Stirling technology (two sessions); industry perspectives; heavy duty transport technology (two sessions); gas turbine technology; and ceramic technology (two sessions). (DLC)

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 11498

11486 (CONF-8410367—, pp 71-77) Converting an agricultural tractor to biogas turbojet operation. Fankhauser, J. 1984. (In German and English). NTIS (US Sales Only), PC A07/MF A01. File Number DE86770072.

From 42. international meeting on agricultural technology; Neu-Ulm, F.R. Germany (25 Oct 1984).

Biogas is an excellent fuel for engines with spark ignition due to its high knock resistance. In cases where there is not enough biogas available, the pilot spray system is advantageous. The only alterations necessary, in a direct injection diesel engine are limited to the gas inlet into the intake pipe and the adaptation of the engine regulation. The main problem in using biogas as a fuel lies in the space required for the tank. The author goes into the results of experiments on a converted diesel tractor. There is an electric switch on the instrument panel for switching from diesel to biogas fuelling.

11487 (DOE/NASA—0340-1) Computer simulation of the turbo-charged turbocompounded diesel engine system: a description of the thermodynamic and heat transfer models. Assanis, D.N.; Ekchian, J.E.; Frank, R.M.; Heywood, J.B. (Massachusetts Inst. of Tech., Cambridge (USA). Sloan Automotive Lab.). Aug 1985. Contract AI01-80CS50194. 104p. (NASA-CR—174971). NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86005012.

A computer simulation of the turbocharged turbocompounded direct-injection diesel engine system has been developed in order to study the performance characteristics of the total system as major design paramters and materials are varied. Quasi-steady flow models of the compressor, turbines, manifolds, intercooler, and ducting are coupled with a multi-cylinder reciprocator diesel model, where each cylinder undergoes the same thermodynamic cycle. The master cylinder model describes the reciprocator intake, compression, combustion and exhaust processes in sufficient detail to define the mass and energy transfers in each sub-system of the total engine system. Appropriate thermal loading models relate the heat flow through critical system components to material properties and design details. From this information, the simulation predicts the performance gains, and assesses the system design trade-offs which would result from the introduction of selected heat transfer reduction materials in key system components, over a range of operating conditions. 53 refs., 7 figs., 3 tabs.

11488 (ORNL/Sub—85-27420/1) Waste heat recovery in a 1600 cc methanol fueled engine. Swain, M.R.; Scott, P.V.; Swain, M.N. (Miami Univ., Coral Gables, FL (USA)). Jan 1986. Contract AC05-84OR21400. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005260.

The results of an experimental and theoretical investigation are presented in this report. The purpose of the investigation was to compare various methods of utilizing methanol as a fuel for reciprocating piston type internal combustion engines. Three different methods of fuel preparation were analyzed. The three methods of fuel preparation were: (1) methanol dissociation with waste heat prior to entering intake manifold; (2) methanol vaporization with waste heat prior to entering intake manifold; and (3) methanol vaporization with waste heat within the cylinder during the compression stroke. The results of the investigation are presented as miles per gallon of methanol for the three fueling methods. 5 refs., 5 figs., 5 tabs.

3302 External Combustion Engines

REFER ALSO TO CITATION(S) 11517

11489 (DOE/CE/50043—1) Evaluation of alternate-fuels performance in an external combustion system. Final report. Battista, R.A.; Connelly, M. (Mechanical Technology, Inc., Latham, NY (USA)). Dec 1985. Contract AC01-84CE50043. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004901.

As the economic attractiveness of many alternate fuels increases relative to gasoline, the viability of any future automotive power plant may soon depend on the ease with which these alternate fuels can be utilized. It is generally assumed that external-combustion engines are more tolerant of alternate fuels than internal-combustion engines. This study attempted to verify that assumption. The purpose of the Alternate-Fuels Performance Evaluation Program was to evaluate and compare the impact of burning six different liquids fuels in an external-combustion system. Testing was conducted in the automotive Stirling engine (ASE) combustion performance rig, which duplicates the external heat system (EHS) of a Stirling engine. The program expanded the range of fuels evaluated over previous studies conducted at Mechanical Technology Incorporated (MTI). The specific objective was to determine the optimal combustion stoichiometry considering the performance parameters of combustion efficiency, temperature profile, exhaust emissions, and burner wall temperature. 14 refs., 34 figs., 6 tabs.

11490 (DOE/NASA—0312-1) Ceramic Automotive Stirling Engine study. Musikant, S.; Chiu, W.; Darooka, D.; Mullings, D.M.; Johnson, C.A. (General Electric Co., Philadelphia, PA (USA). Space Systems Div.). Jan 1985. Contract AI01-85CE50112. 338p. (NASA-CR—174907). NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE86005045.

A conceptual design study for a Ceramic Automotive Stirling Engine (CASE) was performed. Year 1990 structural ceramic technology was assumed. Structural and performance analyses of the conceptual design were performed as well as manufacturing and cost analysis. The general conclusions from this study are that an engine using ceramic hot parts would be 10 to 26% more efficient over its performance map than the current metal Automotive Stirling Reference Engine (ASRE). Cost of such a ceramic engine is likely to be somewhat higher than that of the ASRE but engine cost is very sensitive to the ultimate cost of the high purity, ceramic powder raw materials required to fabricate high performance parts. When the design study was projected to the year 2000 technology, substantial net efficiency improvements, on the order of 25 to 46% over the ASRE, were computed. This design employed advanced heat pipe technology in addition to year 2000 ceramic technology. 5 refs.

11491 (DOE/NASA—1005-7) Overview of free-piston Stirling technology at the NASA Lewis Research Center. Slaby, J.G. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1985. Contract AI05-82OR21005. 19p. (NASA-TM—87156; CONF-8510103—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86003187.

From Automotive technology development contractors' coordination meeting; Dearborn, MI, USA (20 Oct 1985).

The activities include: (1) a generic free-piston Stirling technology project being conducted to develop technologies synergistic to both space power and terrestrial heat pump applications in a cooperative, cost-shared effort with the Department of Energy (DOE/Oak Ridge National Laboratory (ORNL)), and (2) a free-piston Stirling space power technology demonstration project as part of the SP-100 program being conducted in support of the Department of Defense (DOD), DOE, and NASA/Lewis. The gener-

ic technology effort includes extensive parametric testing of a 1 kW free-piston Stirling engine (RE-1000), development and validation of a free-piston Stirling performance computer code, and fabrication and initial testing of an hydraulic output modification for the RE-1000 engine. The space power technology effort, under SP-100, addresses the status of the 25 kWe Space Power Demonstrator Engine (SPDE) including early test results.

11492 **(DOE/NASA/50112—60) Stirling engine supporting research and technology.** Tomazic, W.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1985. Contract AI01-85CE50112. 18p. (NASA-TM—87175; CONF-8510103—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86003202.

From Automotive technology development contractors' coordination meeting; Dearborn, MI, USA (20 Oct 1985).

The supporting research and technology effort is intended to provide technical support to the current engine program and also to investigate advanced concepts for the next generation of Stirling engines. Technical areas represented are: seals, materials, engine experiments, combustion, system analysis, ceramics, and tribology. This paper presents a collage of more recent work in each area. Under seals, analysis and some experimental data on the effect of wear on rod seal performance are presented. The material work described concerns the effect of water content on hydrogen permeation. Results of experiments with the Philips' Advenco engine are presented. A comparison is made of two combustor nozzles, an air-atomizing and an ultrasonic atomizing nozzle. A new venture in systems analysis to provide more rigorous Stirling engine simulation is discussed. The results of hydrogen corrosion tests on silicon carbide are presented. Friction and wear tests on candidate materials for engine "hot ring" tests are discussed.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 11362, 11368, 11369

11493 **(ANL/SPG—26) Role of electric vehicles in the nation's energy future.** Asbury, J.G.; Seay, J.G.; Walsh, W.J. (Argonne National Lab., IL (USA)). Nov 1984. Contract W-31-109-ENG-38. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86003295.

This report examines the role of the electric vehicle (EV) in meeting future transportation needs. First, the transportation fuel outlook is described in terms of historical and projected trends regarding the nation's dependence on foreign oil, and the future costs of domestic substitutes for petroleum, including oil from shale and methanol from coal, are estimated and compared. Then, an economic comparison of the EV with the internal combustion engine (ICE) vehicle, the latter fueled with energy from domestic sources, is presented. Battery "break-even" cost and performance requirements are established, along with the prospects for meeting them through candidate battery technologies. An analysis of requirements is carried out for commuter cars, family compacts, delivery vans, and full-performance automobiles. Because advanced batteries will be more powerful and compact than today's traction batteries, EV acceleration, passenger comfort, and safety will soon match those of ICE vehicles. However, range is inherently expensive for EVs, and commercial EV markets will likely focus on applications requiring ranges of less than 200 miles. The EV represents an important long-run transportation alternative for the United States, and its impact on the nation's electrical supply system will be modest.

11494 **(DOE/RL/01830—T40) Status of electric vehicle battery development and manufacturing activities outside of the United States.** Swisher, J.H. (E and A Associates, Murphysboro, IL (USA)). Dec 1985. Contract AC06-76RL01830. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004215.

A study was conducted to summarize and analyze current activities outside of the United States in battery technology for electric vehicles. Emphasis was placed on batteries which are either commercially available now or may be fully developed within the next ten years. The battery systems of greatest interest currently are sodium/sulfur, nickel/iron, zinc/bromine, and advanced lead/acid. The countries with the largest programs are England, Japan, and the Federal Republic of Germany. Performance and cost goals for each system do not vary significantly from one country to another, with the possible exception of the Soviet Union. The number of joint ventures and consortia that have formed in recent years has increased, and international cooperation is now an important feature of current activities in battery technology. US Executive Branch policy is now very supportive of joint ventures. For this and other reasons, organizations in the United States could benefit from increased involvement in cooperative international activities.

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 11495

3305 Flywheel Propulsion

11495 **Matched metal die compression molded structural random fiber fiber sheet molding compound flywheel.** Kulkarni, S. V.; Christensen, R. M.; Toland, R. H. (to The United States of America as represented by the United States Department of Energy, Washington, DC). US Patent 4,537,091. 27 Aug 1985. Filed date 1 Apr 1983. vp.

PAT-APPL-479193.

A flywheel (10) is described that is useful for energy storage in a hybrid vehicle automotive power system or in some stationary applications. The flywheel (10) has a body of essentially planar isotropic high strength structural random fiber sheet molding compound (SMC-R). The flywheel (10) may be economically produced by a matched metal die compression molding process. The flywheel (10) makes energy intensive efficient use of a fiber/resin composite while having a shape designed by theory assuming planar isotropy.

3306 Vehicle Design Factors

11496 (CONF-8411226—Trans., pp 181-200) **Vehicle refrigeration.** Winter, F. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

This is a practice-oriented overview of goods distribution systems by means of refrigerated vehicles, with remarks on questions of logistics and the operational safety of generators, in-cab monitoring systems and 'eutectic tubes'. Distinctions are made between long-distance, short-distance and distribution processes, and between stopper, semi-compact stopper, systems with external or internal evaporator for the type of vehicle construction. Comments on the generators are applied to the limits for use, investment costs, brine filling and provision of cooling, based on the characteristic line diagram. With regard to the eutectic tube, the author goes into various cooling media and experiments on contact of the cooling medium with food (as a result of leakages in the system). General details are also given on monitoring the functioning of the vehicle refrigeration equipment from the cab (temperature checks; display of heat, cool or defrost command; fault warning; 2-phase monitoring; automatic adjustment of rev direction; humidity intake control). Economic efficiency is considered, supplemented by diagram details. The target of further development trends is reducing running costs to a minimum and improving operational reliability, and also reducing exhaust emission as far as possible and improving noise protection.

11497 (CONF-8411226—Trans., pp 297-310) **Comparative studies on deep freeze distribution vehicles.** Jehle, R. 1984. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86770071.

From Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V.; Baden-Baden, F.R. Germany (21 Nov 1984).

A large number of deep freeze distribution vehicles are equipped with eutectic cold storage systems, which are subject to few breakdowns because of their simply-constructed noise-free cold circuit. The snag, however, has been the relatively high weight of the steel storage plates up to now. For this reason, modern deep freeze equipment is being fitted with aluminium and synthetic storage tubes. The international ATP regulations for short-life foods set

an overall heat throughflow coefficient of less than 0.4 $W/m^3 K$ for 12 hours transport time in freezer vehicles. A report is given of tests relating to this on 6 freezer vehicles with different types of equipment (thermal insulation, cooling equipment). The length of time required for freezing was worked out, as were the heat throughflow coefficient, figures for the electric counter-heating, internal air temperature, storage performance under varying conditions and the course of the cooling down curves. The test results were compared under ATP and DIN 8959 regulations.

3307 Emission Control

11498 **(PB—85-238582/XAB) Characterization of exhaust emissions from alcohol-fueled vehicles. Final report.** Smith, L.R. (Southwest Research Inst., San Antonio, TX (USA)). May 1985. 195p. (SWRI—7670). NTIS, PC A09/MF A01.

The report describes the laboratory effort to develop analytical techniques to characterize exhaust emissions from neat methanol and ethanol-fueled vehicles. Analytical techniques were developed or modified to allow the measurement of methanol, ethanol, aldehydes and ketones, methyl nitrite, and formic and acetic acid in both raw and CVS-diluted exhaust. The methods were validated, qualified, and then used to evaluate exhaust emissions from a 1981 Ford Escort chassis with a 1983 1.6-liter methanol-fueled Ford Escort engine. The vehicle was evaluated over the Light-Duty Federal Test Procedure (FTP) and at 30 and 55 mph steady-state operation both with and without a catalytic converter. In addition to testing conducted with the 90% methanol/10% gasoline fuel blend for which the Ford Escort engine was designed, testing was also conducted with 100% methanol fuel. Other areas investigated included unburned fuel hydrocarbon composition, FID response correction for alcohols as compared with propane, and losses of unburned fuel and aldehydes in the sampling system.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 11486, 11489

11499 **(CONF-851201—10) Stability and composition of palm, coconut and soy oil fatty acid microemulsion diesel fuels.** Compere, A.L.; Griffith, W.L.; Googin, J.M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005017.

From 7. Miami international conference on alternative energy sources; Miami Beach, FL, USA (9 Dec 1985).

Microemulsions fuels containing fully and partially coconut, palm, and soy fatty acids; varying amounts of C_1 to C_4 alcohols; varying amounts of water; and four fuel bases were evaluated between 0 and 60°C for stability as a single phase system. In general, ability to form a stable single phase system rose with increasing alcohol chain length, decreasing water, and increasing dispersed phase content. It was possible to form 0 to 60°C stable single phase systems in all four fuels tested using 30 to 50% v/v dispersed phase containing 1-butanol and either palm or soy fatty acids. 11 refs., 3 tabs.

11500 (CONF-8410367—, pp 48-66) **New diesel engine development for the use of vegetable oil as a fuel.** Elsbett, L. 1984. (In German and English). NTIS (US Sales Only), PC A07/MF A01. File Number DE86770072.

From 42. international meeting on agricultural technology; Neu-Ulm, F.R. Germany (25 Oct 1984).

The Elsbett-Institut is dealing with the development and improvement of the diesel engine heat balance in passenger car and lorry engines. This includes making the engines suitable for several different fuels. A diesel engine that operates on the Duotherm combination process is presented. It is distinguished, for instance, by the fact that it can be run on vegetable oils of the most varied kinds. The engine design, the combustion process and its performance by comparison with comparable Otto and diesel engines are presented. Emphasis is placed on its ecological 'cleanliness' compared with engines that run on mineral oil. At the same time, it is pointed out that the arid areas in North Africa would be ideally suitable for supplying the vegetable oil required for this engine type.

11501 (CONF-8410367—, pp 67-70) **Practical experiences with rape-seed oil ester as fuel for tractors.** Vellguth, G. 1984. (In German and English). NTIS (US Sales Only), PC A07/MF A01. File Number DE86770072.

From 42. international meeting on agricultural technology; Neu-Ulm, F.R. Germany (25 Oct 1984).

Systematic tests under lab conditions have shown that vegetable oils are well suited to use as a fuel for direct injection diesel engines after being transesterified to methylester or ethylester. Once it has been industrially estered, the vegetable e.g. rape seed oil can be transported and stored in ordinary containers with no special precautions relating to safety or materials. The performance in operation of a tractor on which experiments were carried out, also proved to be good. The approximately 10% loss of performance capacity due to the lower energy content of the ester by comparison with diesel fuel was cancelled out when the injection pump was adjusted to admit more fuel.

11502 **(DOE/CE/50070—T6) Synthetic Fuel Center operation. Monthly progress report No. 2, 1-31 December 1985.** Sefer, N.R.; Erwin, J. (Southwest Research Inst., San Antonio, TX (USA). Fuels and Lubricants Research Div.). 10 Jan 1986. Contract AC01-84CE50070. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004885.

The mission of the Synthetic Fuel Center is to provide test quantities of special fuels to the research projects of the AFUP. The fuels have met defined composition and property objectives or have conformed to assessments of future fuel composition. These fuels are produced from divers sources including shale, coal, tar sands, and petroleum stocks and have included alcohols and vegetable oils. In the first three years of operation, the Center completed the laboratory and pilot plant, provided 26 fuels to 11 AFUP projects, and made two presentations of its work and five roundtable discussions.

36 MATERIALS

REFER ALSO TO CITATION(S) 10790, 12273

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 10795, 10896, 11025, 11225, 11231, 11270, 11341, 11359, 11371, 11413, 11600, 11788, 12114, 12115, 12489, 12491

11503 **(AECL—8368) Effect of irradiation and irradiation temperature on the fracture toughness of cold-worked Zr-2.5 wt percent Nb.** Simpson, L.A.; Ellis, R.B.; Stark, D.J.; Shillinglaw, A.J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Sep 1984. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700476.

The use of fracture mechanics methods and small specimens to assess the effect of metallurgical variables on fracture toughness and critical crack length in reactor pressure tubes is reviewed. Fracture toughness tests on specimens irradiated in the NRU research reactor at 260 degrees C are described and compared with results from a previous irradiation in the WR-1 research reactor at 350 degrees C. The J-resistance curve is used as the measure of fracture toughness, and is shown to be very sensitive to the metallurgical state. The lower irradiation temperature (260 degrees C), characteristic of the operating temperature range for power reactors, has a significant effect on fracture toughness. Circumferential hydrides also have an effect. Estimates of critical crack length are made using the J-resistance data, and are seen to slightly underestimate the actual critical crack length as determined in full-scale burst tests. This conservatism is not large enough to impose a significant penalty in design applications.

11504 **(AECL—8381) Hydrogen-induced cracking: 2. Effect of stress on nucleation, growth and coarsening of zirconium hydride precipitates.** Puls, M.P. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Dec 1984. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700477.

There is a strong motivation for understanding the factors controlling zirconium hydride reorientation under stress because of the important role this plays in hydrogen-induced crack growth and/or crack initiation in zirconium and its alloys, particularly under thermal cycling conditions. Following an approach developed by Sauthoff, an analysis of the orienting effect of external stress on the nucleation, growth and coarsening of γ- and delta-zirconium hydride precipitates in zirconium and its alloys is presented. The analysis is based on a previous theoretical study of some of the factors affecting hydride solubility in stressed and unstressed solids. Expressions are derived for the effect of stress on nucleation, growth and coarsening. We conclude, on the basis of these that the preferential orientation of hydride precipitates under stress is most efficient during the nucleation stage. The reason for this is that the overall driving force for nucleation, for the chosen parameters and the usual experimental conditions, is fairly small. Therefore, the driving force for orientating under stress can be a substantial fraction of the overall driving force. The analysis shows that hydride growth is unlikely to play a role in preferential orientation, but coarsening could be important under carefully chosen experimental conditions, which may be relevant to the hydride-cracking process.

11505 **(CEA-CONF—7777) Calorimetric investigation of the Y-Er magnetic phase diagram.** Bonjour, E.; Calemczuk, R.; Caudron, R.; Safa, H.; Monod, P.; Gandit, P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Aug 1984. 2p. (CONF-840842—35-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750350.

From 17. international conference on low temperature physics; Karlsruhe, F.R. Germany (15 Aug 1984).

Published in summamry form only.

11506 **(CONF-841218—29) Hydrogen-induced reconstruction of stepped W(001) surfaces studied with LEED and EELS.** Wendelken, J.F.; Wang, G.C. (Oak Ridge National Lab., TN (USA)). Nov 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004806.

From 31. national vacuum symposium; Reno, NV, USA (3 Dec 1984).

Low energy electron diffraction patterns show that the W(001) surface reconstructs at room temperature when exposed to hydrogen with a $(\sqrt{2}x\sqrt{2})R45^{\circ}$ structure having a c2mm symmetry. Vibrational EELS data indicate that the tungsten atoms move together to form dimers which must be aligned in <10> directions to satisfy the symmetry requirements. The two possible dimer orientations define two orthogonal, degenerate domains. It has been shown that steps on a surface may limit the growth of the reconstruction domains and may also influence the relative abundance of the domain orientations. We report here an extension of previous work on step effects involving the relationship of step orientation to domain growth and selection. 7 refs., 2 figs.

11507 **(CONF-841246—30) Perspective on present and future alloy development efforts on austenitic stainless steels for fusion application.** Maziasz, P.J. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004808.

From 1. international conference on fusion reactor materials; Tokyo, Japan (3 Dec 1984).

The purpose of this paper is to address important questions concerning how to effect further alloy development of austenitic stainless steels for resistance, and to what extent the behavior of other properties under irradiation, such as strength/embrittlement, fatigue/irradiation creep, corrosion (under irradiation), and radiation-induced activation must be influenced. To summarize current understanding, helium has been found to have major effects on swelling and embrittlement, but several metallurgical avenues are available for significant improvement relative to type 316 stainless steel. Studies on fatigue and irradiation creep, particularly including helium effects, are preliminary but have yet to reveal engineering problems requiring additional alloy development remedies. The effects of irradiation on corrosion behavior are unknown, but higher alloy nickel contents make thermal corrosion in lithium worse. 67 refs. (JDB)

11508 **(CONF-850871—22) Magnetic depth profiles by neutron reflection.** Felcher, G.P.; Gray, K.E.; Kampwirth, R.T.; Brodsky, M.B. (Argonne National Lab., IL (USA)). Sep 1985. Contract W-31-109-ENG-38. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004202.

From International conference on neutron scattering; Santa Fe, NM, USA (19 Aug 1985).

Fresnel reflection of polarized neutrons was used to measure the dependence of magnetic induction B in materials as a function of depth from the surface. The penetration depth of a magnetic field is superconductors was investigated, as well as the remnant superconducting surface sheath when the applied field exceeded the critical value (H/sub c2/ < H < H/sub c3/ in type II superconductors). In addition ferromagnets in bulk and in thin layers were examined. The prototype instrument with which the measurements were made was described. 19 refs., 5 figs. (WRF)

11509 **(CONF-8510168—5) Effects of rapidly pulsed ion bombardment on microstructure and phase stability in a Ti-modified stainless steel.** Lee, E.H.; Packan, N.H.; Lewis, M.B.; Mansur, L.K. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004790.

From TMS/AIME fall meeting; Toronto, Canada (13 Oct 1985).

A low-swelling Ti-modified austenitic stainless steel has been bombarded with pulsed 4 MeV Ni^{++} and in some cases simultaneously with 0.2 to 0.4 MeV He^{+} ion beams at 948°K over a dose range from 1 to 70 dpa. The interruption periods studied were 60, 1, 10^{-3}, or 10^{-5} s on time with equal off time. At 1 dpa, pulsed irradiation caused interstitial dislocation loops (and subsequent MC precipitates) to be more refined with decreasing pulse periods down to the realm of the vacancy lifetime (10^{-1} to 10^{-3} s); still faster pulsing at 10^{-5} s yielded little difference from steady irradiation. At higher doses, 40 to 70 dpa, pulsing reduced the amount of radiation-induced G phase. Long pulse periods promoted the thermally-stable MC phase, while shorter periods like 10^{-3} s aided M_6C and $M_{23}C_6$ development. In helium-implanted material bubbles were present for all pulsing conditions but bias-driven voids only developed in continuously-irradiated specimens. The results are interpreted with regard to the inherent fluctuations in point defect concentrations that result from cascade formation.

11510 **(CONF-8510168—6) Cascade-induced fluctuations and the transition from the stable to the critical cavity radius for swelling.** Hayns, M.R.; Mansur, L.K. (Oak Ridge National Lab., TN (USA); UKAEA Safety and Reliability Directorate, Culcheth). 1985. Contract AC05-84OR21400. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005020.

From TMS/AIME fall meeting; Toronto, Canada (13 Oct 1985).

Recently, a cascade diffusion theory was developed to understand cacade-induced fluctuations in point defect flux during irradiation. Application of the theory revealed that such fluctuations give rise to a mechanism of cascade-induced creep that is predicted to be of significant magnitude. Here we extend the investigation to the formation of cavities. Specifically, we explore the possible importance of cascade-induced cavity growth excursions in triggering a transition from the gas-content-dictated stable radius to the critical radius for bias-driven growth. Two methods of analysis are employed. The first uses the variance of fluctuations to assess the average effect of fluctuations. The second is based on the fact that in a large ensemble of cavities, a small fraction will experience larger than average excursions. This prospect is assessed by estimating upper limits to the processes. For the conditions considered, it is concluded that cascade-induced fluctuations are of minor importance in triggering the onset of swelling in a population of stable gas-containing cavities.

11511 **(DOE/ER/13150—T2) Laser studies of chemical dynamics at the gas-solid interface. Progress report.** Cavanagh, R.R.; King, D.S. (National Bureau of Standards, Washington, DC (USA). Center for Chemical Physics). 14 Oct 1985. Contract AI05-84ER13150. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004690.

The pathways and rates of energy transfer at surfaces remain some of the key unresolved issues for understanding chemical reactions occurring at this interface region. A dedicated experimental facility incorporating both sophisticated laser probes and modern surface diagnostics is being applied to the study of the thermal desorption of molecules chemisorbed on well-characterized surfaces. The thermal desorption process was chosen for initial study because thermally activated desorption, and its reverse, trapping, are key steps for the control of heterogeneous reactions. While it is frequently assumed that the desorbed species may be described in terms of equilibration with the substrate heat bath, there have been no previous direct tests of the validity of this assumption. In fact, our earlier measurements of NO thermally desorbed from Ru(001) indicated this not to be the case. In the past year we have taken a detailed look at the thermal desorption of NO from Pt(111). Emphasis was placed on trying to uncover the relative importance of adsorbate-surface versus adsorbate-adsorbate interactions. In addition, we have assembled a high vacuum test station to investigate the effects of rapid pulsed laser heating on an adsorbate covered surface (Pt foil).

11512 **(DOE/ER/45055—15) Summary of recent research on mechanical behavior of polycrystalline solids. Progress report, March 1985-March 1986.** Li, C.Y. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). Nov 1985. Contract FG02-84ER45055. 70p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004635.

This report covers recent research on the mechanical properties of polycrystalline solids in the following areas: load relaxation studies of solute-dislocation interactions during strain aging, a state variable approach to grain boundary sliding and related phenomena, mechanical testing at elevated strain rates, and finite element modeling of nonelastic deformation process by using state variable constitutive relations.

11513 **(DOE/ER/45173—1-1985) Corrosion Research Center of the University of Minnesota. Progress report, January 1-December 31, 1985.** Oriani, R.A. (Minnesota Univ., Minneapolis (USA). Corrosion Research Center). Dec 1985. Contract FG02-84ER45173. 209p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86004404.

The following topics in aqueous and high-temperature corrosion were studied: passivation on GaAs, adsorption on electrode surfaces, theory, passivation, passive films on Ti, corrosion protection by conductive polymers, interfaces, scaling, molten carbonates, etc. (DLC)

11514 **(DOE/ER/52068—T10) Development of high field superconductors for fusion energy applications. Progress report, August 1, 1984-January 15, 1985.** (Supercon, Inc., Shrewsbury, MA (USA)). 1985. Contract AC01-80ER52068. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004834.

Fabrication and testing of superconducting materials is discussed. Fabrication of the X-type internal bronze material to 0.016 in. (0.406 mm) diameter yields 720 A/mm^2 in the non-copper at 10 T and 4.2 K and a sensitivity of 1.5 μV/cm. Plans for the preparation of the MIT test coil are reported. 1 ref., 2 figs. (WRF)

11515 **(DOE/ER/52068—T11) Development of high field superconductors for fusion energy applications. Progress report, 9/1/83-11/30/83.** (Supercon, Inc., Natick, MA (USA)). 1983. Contract AC01-80ER52068. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004838.

Methods for producing both the bronze and the high tin type of composite Nb_3Sn conductors are reported. In addition, an experiment was devised to examine the feasibility of vapor depositing aluminum on niobium sheet and then rolling it up to form a "jelly roll" type Nb_3Al conductor. A billet was assembled for extrusion of a copper clad niobium tube. This will be used for forming the basic filament in high tin type conductors. Experiments were made to test the feasibility of assembling tin cored filaments into billets and extruding with heavy lubrication at room temperature in order to improve interfilamentary bonding without melting the tin. A 200 pound ingot of a bronze titanium alloy is being cast.

11516 **(DOE/NASA—0363-1) Creep-rupture behavior of iron superalloys in high-pressure hydrogen.** Bhattacharyya, S.; Peterman, W. (IIT Research Inst., Chicago, IL (USA)). Dec 1985. Contract AI01-77CS51040. 51p. (NASA-CR—175027). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005013.

The creep-rupture behavior of a newly developed cast alloy NASAUT 4G-A1 with 15% Cr, 15% Mn, and 1.5% C was evaluated in 15 MPa H_2 at 775°C and 825°C; the alloy is intended for automotive Stirling heater head application. Rupture life, minimum creep rate, and time to 1% strain data were analyzed. The 3500-h mean rupture stress at 775°C is 140 MPa, exceeding the design stress of 119 MPa. However, significant data scatter caused the 90% confidence level lower limit of the mean stress to be 94.3 MPa, falling below the 119 MPa design stress level. NASAUT 4G-A1 3500-h rupture-life mean stress exceeds the XF-818 values but is lower than SA-F11, HS-31, and CRM-6D (aged). The predicted mean stress to 1% creep in 3500 h was 57.8 MPa and had a very wide scatter indicating a lack of reproducibility in the alloy structure. For a cast alloy, NASAUT 4G-A1 indicated significant ductility with maximum elongation in the range of 6.0 to 13.6% at 775°C. Hydrogen did not seem to affect the stable carbides though some methane was noted in the chamber gas. The microstructure contained some voids, pores, inclusions, and interdendritic separations. The structure consisted of an austenitic phase with two different carbides and was not affected by heat treatment.

11517 **(DOE/NASA/51044—37) Creep rupture behavior of Stirling engine materials.** Titran, R.H.; Scheuerman, C.M.; Stephens, J.R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1985. Contract AI01-77CS51044. 9p. (NASA-TM—87209; CONF-8510103—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005099.

From Automotive technology development contractors' coordination meeting; Dearborn, MI, USA (20 Oct 1985).

The automotive Stirling engine, being investigated jointly by the Department of Energy and NASA Lewis as an alternate to the internal combustion engine, uses high-pressure as the working fluid. The long-term effects of hydrogen on the high temperature strenth properties of materials are relatively unknown. This is especially true for the newly developed low-cost iron base alloy NASAUT 4G-Al. This iron-base alloy when tested in air has creep-rupture strengths in the directionally solidified condition comparable to the cobalt base alloy HS-31. The equiaxed (investment cast) NASAUT 4G-Al has superior creep-rupture to the equiaxed iron-base alloy XF-818 both in air and 15 MPa hydrogen.

11518 **(IC—85/5) Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem.** Oosten, A.B. van; Geertsma, W. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1985. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700478.

In order to study density of states (DOS) effects on the resistivity of liquid metals and alloys we derive a set of integral equations for these quantities so that this set satisfies the generalized optical theorem. The DOS is calculated up to second order in the scattering potential using renormalized propagators. The theory is applicable to weak scattering systems, for example, alkali and alkaline earth metals and, for example, to Li-Pb alloys for compositions where the mean free path is much larger that the average interatomic distance. From our numerical results we conclude that the Ziman equation for the resistivity should be multiplied by g^2=N^2(Esub(F))/N^{2}sub(O)(Esub(F)) where N(Esub(F)) is the DOS at the Fermi level as calculated in our model and Nsub(O)(Esub(F)) is the free electron DOS. This solves the long standing problem of whether or not one should correct the Ziman equation by an effective mass correction. Our model is only valid for alloys consisting of atoms with a small difference in electronegativity. This is clearly shown in the results for the liquid Li-Pb system. Some of the existing resistivity theories for weak and intermediate scattering are examined in the light of our calculations.

11519 **(IC—85/6) Effect of microscopic structure of metal electrode on capacitance of metal - molten salt interface.** Roman, E.; Tosi, M.P.; Grout, P.J.; March, N.H. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1985. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700479.

A brief discussion of both ionic structure and electron spill-out from the metal electrode is given, in relation to the capacitance of the metal-molten salt interface. A microscopic basis can thereby be given to the earlier phenomenological treatment of the capacitance of this interface.

11520 **(IC—85/18) Structure of the scattering diagrams for conductivity in random binary alloys and the self-consistent CCPA.** Mookerjee, A. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1985. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700352.

The augmented space scattering diagrams for the conductivity for random binary alloys have been examined in detail. Within a CCPA it is seen that in addition to the 'uncorrected' conductivity calculated from averaged currents there are three types of corrections: the vertex correction (non-vanishing except in the 1CPA with diagonal disorder), the corrections to the averaged current and a non-separable correction term. A tractable graphical method for obtaining these corrections is described and an application is made to a simple, three-dimensional alloy model.

11521 **(INFO—0113) Welding of carbon steel vessels without post weld heat treatment.** Gibb, M.; Bala, S.R. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jan 1984. 87p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86700474.

The methods available for the repair welding of carbon steel vessels without post weld heat treatment and with particular reference to service in a sour environment have been reviewed. All the available techniques have the common aim of providing adequate properties in the weld metal and heat affected zone without the need for a full post weld stress relief. The heat that is required to provide the necessary metallurgical changes comes, therefore, from an alternate source. The two sources used are heat from suitably placed subsequent weld passes or from localized external heat sources. The technique presently being used by Ontario Hydro to repair vessels subject to sour service utilizes both a high preheat and a welding technique which is designed to temper the heat affected zone formed in the base material by the first weld pass. This technique is an improvement over the 'half bead' techniques given in the ASME X1 code and has been shown to be capable of reducing the hardness of the heat affected zone to an acceptable level. Certain recommendations have been made which could improve control of the technique presently used by Ontario Hydro and provide measurable parameters between procedural tests and the actual weld repairs.

11522 **(LBL—19380) Temperature dependence of the ^{57}Fe hyperfine magnetic field distribution in Fe-Ni.** Fultz, B.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). Mar 1985. Contract AC03-76SF00098. 6p. (CONF-8509193—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005229.

From International conference on applications of the Mossbauer effect; Leuven, Belgium (16 Sep 1985).

The temperature dependence of the ^{57}Fe hyperfine magnetic field (hmf) in Fe-Ni is stronger than the temperature dependence of the ^{57}Fe hmf in pure Fe. By analyzing the shape of the ^{57}Fe hmf distribution, and with the help of experiments with Si in Fe-Ni, we deduce that this anomalous temperature dependence originates from a large thermal sensitivity of the magnetic moments at those Fe atoms with more Ni nearest neighbors. A strong temperature dependence of the recoil-free fraction was also observed in Fe-Ni alloys. We suggest that a large mean square thermal displacement of Fe atoms in Fe-Ni is the cause of the anomalous temperature dependence.

11523 **(LBL—20626) Chaos and turbulence in an electron-hole plasma in germanium.** Held, G.A. (Lawrence Berkeley Lab., CA (USA)). Nov 1985. Contract AC03-76SF00098. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86005225.

Spontaneous current oscillations in an electron-hole plasma in germanium in parallel dc electric and magnetic fields are known to be the result of an unstable helical density wave. When this instability is excited by an increasing electric field, there is a transition to chaotic turbulence similar to that observed in fluids. A number of techniques are employed to characterize the transitions to chaos. Following a quasiperiodic route, the resulting chaotic state is found to be characterized by a strange attractor of fractal dimension between 2 and 3. These "weakly" turbulent instabilities correspond to temporally chaotic, yet essentially spatially coherent plasma density waves. However, when more strongly excited, these plasma density waves undergo a partial loss of spatial coherence and a sudden jump in the dimension of the attractor from less than three for spatially coherent states to an indeterminately large value (>8) after the onset of spatial disorder. Experiments on the coupling of a periodic instability of frequency f_1 to an external perturbation of frequency f_2 are reported. Finally, a rate-equation model, which includes nonlinear coupling between unstable and damped plasma waves, is presented.

11524 **(NUREG/CR—4422) Review of the models and mechanisms for environmentally-assisted crack growth of pressure vessel and piping steels in PWR environments.** Cullen, W.; Gabetta, G.; Hanninen, H. (Materials Engineering Associates, Inc., Lanham, MD (USA); Centro Informazioni Studi Esperienze, Milan (Italy); Valtion Teknillinen Tutkimuskeskus, Helsinki (Finland)). Dec 1985. 115p. (MEA—2078). NTIS, PC A06/MF AO1 - GPO. File Number TI86900460.

The crack-tip micromechanisms and the computational models for environmentally-assisted cracking in pressure vessel and piping steels in high-temperature, low-oxygen (PWR), reactor-grade water are described and evaluated in this report. The report begins with a brief description of the critical variables which are known to affect environmentally-assisted subcritical cracking in these metal/environment systems. The micromechanistic models are discussed in some detail, with anodic dissolution and hydrogen assistance being the prime candidates for the successful explanation of the observed phenomena. The anodic dissolution model offers far better quantification of the environmentally-assisted crack growth rates, but tends to overpredict the rates for a large number of conditions. The hydrogen assistance models qualitatively could account for a wider range of effects, but quantification of the model is virtually nonexistent. A variety of calculational models are in various stages of development; all of them are far from use as a predictive tool. Crack-tip strain rate models have received the most attention, and the approach to their use has been to partition the environmentally-assisted growth rates into a mechanically-driven component, with the environmental enhancement superposed. The environment component is then correlated with a calculated crack-tip strain rate. 141 refs., 59 figs.

11525 **(ORNL—6121) Effects of helium content of microstructural development in Type 316 stainless steel under neutron irradiation.** Maziasz, P.J. (Oak Ridge National Lab., TN (USA)). Nov 1985. Contract AC05-84OR21400. 229p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE86005342.

This work investigated the sensitivity of microstructural evolution, particularly precipitate development, to increased helium content during thermal aging and during neutron irradiation. Helium (110 at. ppM) was cold preinjected into solution annealed (SA) DO-heat type 316 stainess steel (316) via cyclotron irradiation. These specimens were then exposed side by side with uninjected samples. Continuous helium generation was increased considerably relative to EBR-II irradiation by irradiation in HFIR. Data were obtained from quantitative analytical electron microscopy (AEM) in thin foils and on extraction replicas. 480 refs., 86 figs., 19 tabs.

11526 **(PNL-SA—13423) Measurement and prediction of sensitization development in austenitic stainless steels.** Bruemmer, S.M.; Charlot, L.A.; Atteridge, D.G. (Pacific Northwest Labs., Richland, WA (USA)). Oct 1985. Contract AC06-76RL01830. 27p. (CONF-8510173—35). NTIS, PC A03/MF A01 - GPO. File Number TI86002819.

From 13. water reactor safety research information meeting; Gaithersburg, MD, USA (22 Oct 1985).

The effects of thermal and thermomechanical treatments on sensitization development in Type 304 and 316 stainless steels have been measured and compared to model predictions. Sensitization development resulting from isothermal, continuous cooling and pipe welding treatments has been evaluated. An empirically-modified, theoretically-based model is shown to accurately predict material degree of sensitization (DOS) as expressed by the electrochemical potentiokinetic reactivation (EPR) test after both simple and complex treatments. Material DOS is also examined using analytical electron microscopy to document grain boundary chromium depletion and is compared to EPR test results. 9 refs., 13 figs.

11527 **(SAND—85-1208C) Binary and ternary amorphous alloys of ion-implanted Fe-Ti-C.** Follstaedt, D.M.; Knapp, J.A. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 7p. (CONF-851217—18). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004621.

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

The microstructure of Fe implanted with up to 50 at. % C was found to consist of hexagonal iron carbide precipitates oriented with respect to the Fe matrix. For higher C concentrations, an amorphous phase forms. This concentration dependence is explained in terms of the lattice structure of the iron carbide. In Ti-implanted Fe, substitutional Ti was found in the bcc Fe lattice for concentrations $\leqq$15 at. % Ti. The work of others suggests that amporphous phases form for $\geqq$33 at. % Ti. These results are discussed in terms of concentration boundaries of the ternary Fe(Ti,C) amorpous phase.

11528 **(SAND—85-1335C) Formation of surface layers of icosahedral Al(Mn).** Knapp, J.A.; Follstaedt, D.M. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 22p. (CONF-851217—19). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004606.

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

Surfaces layers of the icosahedral phase of Al(Mn) have been formed from thin, alternating Al/Mn layers deposited on Al or Fe surfaces by rapid electron-beam or laser melting, by ion beam mixing, and by solid-state diffusion. The electron beam and laser treatments are similar to other liquid quenching techniques used previously to form the phase, but have well defined temperature histories which place limits on the melting point of the icosahedral phase, the time needed to its nucleation from the melt, and its growth velocity. Ion beam mixing is a way of forming the icosahedral phase which is quite different from melt quenching; the phase is formed during ion beam mixing at temperatures of 100 to 200°C. For mixing at $\leqq$ 60°C an amorphous phase with icosahedral short-range order is formed, and this phase can be converted to the icosahedral phase by subsequent annealing. Formation of the icosahedral phase by reacting the as-deposited layers in the solid state has not been reported elsewhere. The results presented here place new restrictions on proposed structural and thermodynamic models for the icosahedral phase.

11529 **(SAND—85-8245) Crystal plasticity analysis of large-strain shear.** Asaro, R.J.; Lowe, T.C. (Sandia National Labs., Livermore, CA (USA)). Dec 1985. Contract AC04-76DR00789. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005061.

Successful computer prediction of metal forming processes requires accurate constitutive relations to represent large-strain deformation. Crystal plasticity analyses of metal polycrystals subject to large strains are described which will help guide the formulation of such relations. The response of a polycrystalline aggregate of grains is analyzed to illucidate the effects of boundary constraint during large strain shear deformations. Deformation-induced textures are also predicted. Predictions of the Swift effect that is, normal strains that accompany finite shear strains, are compared with experimental data.

11530 **(UWFDM—640) Effects of irradiation and high heat flux on the lifetime performance of ferritic and 316 stainless steels.** Glasgow, B.B. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). 1985. Contract AC02-82ER52082. 162p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86004755.

This report examines the effects of irradiation and high heat flux on the lifetime performance of a ferritic steel structure and compares the results to an identical analysis done using 316 stainless steel. 52 figs.

11531 **Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process.** Suenaga, M.; Welch, D.O.; Sabatini, R.L.; Kammerer, O.F.; Okuda, S. (Division of Metallurgy and Materials Science, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Applied Physics;* 59: No. 3, 840-853(1 Feb 1986). Contract AC02-76CH00016.

Superconducting critical temperatures T/sub c/ and magnetic fields H/sub c/2, lattice parameters a_0, and chemical compositions were measured for "bulk" layers ($\sim$ 6 μm or greater) of "pure" and alloyed Nb_3Sn which were made by the bronze process. The values of T/sub c/, a_0, and the composition of pure Nb_3Sn layers were $\sim$ 18 K, 0.52900 +- 0.00005 nm, and 25 +- 0.5 at. % Sn, respectively, independent of heat-treatment temperature (between 650—780°C) and of the bronze composition, as long as the thickness of the layers was greater than $\sim$ 6 μm. Small additions of Ti ($\sim$ 1 at. %) or Ta ($\sim$ 3 at. %) slightly increased the value of T/sub c/ (by $\sim$0.2—0.4 K) above that for pure Nb_3Sn. However, additions of larger amounts of these elements or addition of other transition elements (V, Zr, and Mo) significantly decreased T/sub c/. Also, small additions of these elements significantly increased H/sub c/2. Specifically, the largest values of H/sub c/2 ($\sim$ 27 T at 4.2 K) were obtained for Nb_3Sn layers containing $\sim$ 1.5 and $\sim$ 4 at. % of Ti and Ta, respectively, compared with a value for the pure Nb_3Sn of 23.5 T at 4.2 K. The value of a_0 decreased with all of the alloying additions; these variations can be explained qualitatively by several models for the lattice parameter of A15 compounds, but none of them can quantitatively predict the variations.

11532 **Raman scattering in experiments with planar Au targets irradiated with 0.53 μm laser light.** Shepard, C.L.; Tarvin, J.A.; Berger, R.L.; Busch, G.E.; Johnson, R.R.; Schroeder, R.J. (KMS Fusion, Inc., Ann Arbor, Michigan 48106). *Physics of Fluids;* 29: No. 2, 583-593(Feb 1986). Contract AC08-82DP40152.

Stimulated Raman scattering (SRS) was studied in experiments with laser-irradiated Au disk targets. Typically the laser energy was 150 J in a 1.0 nsec pulse at a wavelength of 526 nm. Laser intensity at the target was $\sim 7 \times 10^{14}$ W/cm^2. The spectrum, angular distribution, onset time, duration, and intensity of the Raman light were measured. In addition the electron density distribution was determined by holographic interferometry and images of the Raman emission were obtained. These data show that the Raman light is primarily backscattered and that scattering occurs at electron plasma densities 0.01 n/sub c/ $<$ or $=$n$<$ or $=$0.15n/sub c/. SRS occurred at laser intensities which are below theoretical thresholds, given the plasma conditions. Otherwise, most of the data support the present understanding of Raman scattering.

11533 **Prediction of high-energy spin-wave excitation in iron.** Blackman, J.A.; Morgan, T.; Cooke, J.F. (Physics Department, University of Reading, Reading, England). *Physical Review Letters;* 55: No. 25, 2814-2817(16 Dec 1985). Contract AC05-84OR21400.

Calculations have been made of inelastic neutron-scattering cross sections for ferromagnetic iron. Quite unexpectedly, a rich picture of high-energy collective excitations has emerged. In particular, "optic" spin-wave modes with energies ranging to about

750 meV are predicted. Thus, iron is an ideal candidate for a novel high-energy-transfer experiment on recently developed high-energy neutron sources.

11534 **Observation of isolated carbon atoms and the study of their mobility on Pt clusters by NMR.** Wang, P.; Ansermet, J.; Slichter, C.P.; Sinfelt, J.H. (Department of Physics and Materials Research Laboratories, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review Letters;* **55**: No. 24, 2731-2734(9 Dec 1985). Contract AC02-76ER01198.

The authors have used NMR to determine the structure of surface species after the C-C bond scission of adsorbed acetylene and ethylene on Pt clusters produced by heating the samples to 690 K. They have found the species to be predominantly isolated carbon atoms adsorbed on Pt surfaces. They have studied the mobility of adsorbed carbon atoms from motional narrowing of the ^{13}C line shapes and motion-induced shortening of the spin-lattice relaxation times. They have found that the carbon atoms on Pt clusters are very mobile, their activation energy of 7 +- 1 kcal/mole for translational motion being less than half that of CO on Pt clusters.

11535 **ESR in a heavy-fermion alloy (UBe_{13}) doped with local moments.** Gandra, F.; Schultz, S.; Oseroff, S.B.; Fisk, Z.; Smith, J.L. (University of California, San Diego, La Jolla, California 92093). *Physical Review Letters;* **55**: No. 24, 2719-2722(9 Dec 1985).

We have determined the ESR properties of UBe_{13} doped with dilute local moments of Er, Dy, or Gd over the temperature region where there is a large variation in the enhanced specific heat. We find that neither the enhancement, the temperature variation, nor any other anomalous behavior appears to be mirrored in the ESR data. We suggest that this unexpected result must be incorporated into current models of heavy-fermion systems.

11536 **Observation of a collective mode in superconducting UBe_{13}.** Golding, B.; Bishop, D.J.; Batlogg, B.; Haemmerle, W.H.; Fisk, Z.; Smith, J.L.; Ott, H.R. (AT&T Bell Laboratories, Murray Hill, New Jersey 07974). *Physical Review Letters;* **55**: No. 22, 2479-2482(25 Nov 1985).

Sound propagation in the heavy-fermion superconductor UBe_{13} is studied at frequencies from 0.9 to 2.4 GHz and temperatures from 0.01 to 100 K. A peak in the acoustic attenuation is observed below the superconducting transition of 0.9 K, instead of the rapid drop expected for a BCS superconductor. Absorption into a collective mode of a nonsinglet, anisotropic superconductor is proposed.

11537 **Probing the wave function of a surface state in Ag(111): A new approach.** Hsieh, T.C.; Miller, T.; Chiang, T. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review Letters;* **55**: No. 22, 2483-2486(25 Nov 1985). Contract AC02-76ER01198.

The envelope function of a surface state in Ag(111) has been determined with a new experimental approach based on the concept that spatially varying physical quantities near the surface can be probed in real space with the use of samples with tailored atomic configurations. Samples of Ag(111) with one near-surface atomic layer replaced by a closely matched Au atomic layer were fabricated by molecular-beam epitaxy.

11538 **Assessment of the melting, boiling, and critical point data of the alkali metals.** Ohse, R.W.; Babelot, J.F.; Magill, J.; Tetenbaum, M. (Commission of the European Communities, Karlsruhe, Germany, F.R., Joint Research Centre; Argonne National Lab., IL, USA). *Pure and Applied Chemistry;* **57**: No. 10, 1407-1426(Oct 1985).

The measured melting, boiling and critical point data of the alkali metals are reviewed. Emphasis has been given to the assessment of the critical point data. The main experimental techniques for measurements in the critical region are described. The selected data are given. Best estimates of the critical constants of lithium are given.

11539 **Amorphous phase transition in irradiated NiTi alloy.** Brimhall, J.L.; Kissinger, H.E.; Pelton, A.R. (Battelle Pacific Northwest Labs., Richland, WA, USA; Ames Lab., IA, USA). *Radiation Effects;* **90**: No. 3-4, 241-258(Sep 1985).

Observed supralinear dose dependence for the amorphous transformation during irradiation of NiTi is compatible with a cascade overlap model for heavy ion (2.5 MeV Ni^{+}, 6 MeV Ta^{+++}) irradiations. A model based on total defect build-up, however, is necessary to explain the amorphous transition induced by electron irradiation and can also be applied to heavy ion irradiation. The cascade effects in this latter model are manifested by non-uniform defect distribution in the lattice. The defect build-up model requires a high activation energy for interstitial migration which is not incompatible with recent findings. The form of the temperature dependence can also be rationalized using a defect build-up model (amorphous phase transition, heavy-ion irradiation, electron irradiation, NiTi, defect build-up, cascade overlap).

11540 **One MeV electron irradiation of pure nickel compared to lithium-implanted nickel.** Seshan, K.; Baldo, P.; Wiedersich, H. (Arizona Univ., Tucson, USA. Dept. of Metallurgical Engineering; Argonne National Lab., IL, USA). *Radiation Effects;* **90**: No. 3-4, 283-295(Sep 1985).

Pure nickel and lithium-implanted nickel were irradiated with 1 MeV electrons at the Argonne HVEM-Tandem facility. The lithium-implanted nickel was not damaged as readily as the pure nickel under 1 MeV electron irradiation in the temperature range 20 to 600°C. The decreased damage accumulation in the lithiated nickel could arise from both the precipitated lithium and that in solution. The latter could slow down the nickel interstitials produced during irradiation by association, thus enhancing their recombination with vacancies. The interfaces of the precipitated lithium could also act as unbiased sinks for the vacancies and interstitials. Above 600°C, under electron irradiation, a melting process which created small irregular shaped regions occurred in the lithium-implanted nickel. Electron diffraction analysis showed that the compound Li_3NiO_2 was formed inside these regions.

11541 **Method for producing hard-surfaced tools and machine components.** McHargue, C. J. (to The United States of America as represented by the United States Department of Energy). US Patent 4,532,149. 30 Jul 1985. Filed date 27 Jul 1983. vp.

PAT-APPL-517049.

In one aspect, the invention comprises a method for producing tools and machine components having superhard crystalline-ceramic work surfaces. Broadly, the method comprises two steps: A tool or machine component having a ceramic near-surface region is mounted in ion-implantation apparatus. The region then is implanted with metal ions to form, in the region, a metastable alloy of the ions and said ceramic. The region containing the alloy is characterized by a significant increase in hardness properties, such as microhardness, fracture-toughness, and/or scratch-resistance. The resulting improved article has good thermal stability at temperatures characteristic of typical tool and machine-component uses. The method is relatively simple and reproducible.

11542 **Superplastic properties of an Al-Cu-Li-Zr alloy.** Wadsworth, J.; Henshall, C.A.; Pelton, A.R.; Ward, B. (Lockheed Research Labs., Palo Alto, CA; Dept. of Energy, Ames, IA; Reynolds Metals Co., Richmond, VA). *Journal of Materials Science Letters;* **4**: 674-678(Jun 1985).

Experimental results are presented for the superplastic deformation properties of an Al-Li alloy of composition Al-4Cu-2Li-0.15Zr, whose 50-mm thick initial slabs are manufactured by ingot metallurgy. Elongations-to-failure are presented as a function of strain rate at several temperatures over the 400-500 C range. The best superplastic properties were observed in the 450-500 C range, with several values exceeding 1000 percent elongation. The thermomechanical processing technique employed for superplastic forming, which leads to discontinuous crystallization, is the basis for the achievement of grain sizes as fine as 2.3 microns. 12 references.

11543 Applications of heavy-ion Rutherford backscattering spectrometry (HIRBS) to the analysis of contact structures on GaAs and Ge. Yu, K.M.; Jaklevic, J.M.; Haller, E.E. (Lawrence Berkeley Lab., CA, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 606-610(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

The use of Heavy-Ion Rutherford Backscattering (HIRBS) for the analysis of layered structures on GaAs and Ge substrates has been studied. Direct comparisons of data obtained using both ^{16}O and ^{4}He projectiles for the characterization of contact structures have demonstrated the advantages of HIRBS for the study of substrates with increasing atomic masses due to the improved mass resolution of the method for high Z materials. We present results obtained from a study of thermally induced interactions between GaAs and Ge substrates and the metals Pt and Pd. Results of the analysis of multiple layered structures on GaAs and GaAlAs substrate with HIRBS are also discussed.

11544 Current research using the ANL High Voltage Electron Microscope Tandem Accelerator facility. Taylor, A.; Ryan, E.A. (Argonne National Lab., IL, USA. Materials Science and Technology Div.). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 687-692(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117–46.

Recent work at the Argonne National Laboratory (ANL) HVEM - Tandem Accelerator user facility is summarized: direct observation of cluster defects formed by in-situ ion irradiation at low temperature using the ion-beam interface has led to important fundamental results on defect production processes. Results on solute segregation at devated temperatures induced by electron and ion irradiation are reported. Other published work is briefly summarized and/or referenced.

11545 Precipitate formation in austenitic stainless steel welds. Cieslak, M.J.; Ritter, A.M. (Sandia National Laboratories, Albuquerque, NM). *Scripta Metallurgica;* **19**: No. 2, 165-168(Feb 1985).

Recent research efforts have revealed many of the factors which control the hotcracking susceptibility of austenitic stainless steel weld metals. It is generally agreed that the segregation of impurity elements to solidification grain boundaries is a primary cause of the hot-cracking tendency of these alloys in that elements such as phosphorus and sulfur form low melting point eutectics with the metal matrix. Furthermore, these elements can also degrade cracking resistance by lowering the surface tension of the interdendritic fluids to which they segregate. In the case of phosphide precipitation in austenitic stainless steel weld metal, there is apparently some question in the literature as to the specific phosphide formed. This study was undertaken to determine the microstructural relationships, relative to phosphide formation, pertaining to hot-cracking of austenitic stainless steel weld metals. The results confirm that phosphides of the type $(Fe, Cr)_3P$ form in austenitic stainless steel welds. These phosphides appear at both eutecticferrite/austenite interfaces and along solidification hot-cracks, where they most likely form via an eutectic reaction. These results are inconsistent with those of Brooks et al. in that no evidence of either the MP or MP_3 phosphide was found. No reference could be found, either in the published literature or in standard compilations of crystallographic information, to verify the existence of a CrP_3 phase, suggesting that the theory of chromium depletion (CrP_3 vs. CrS) needs further substantiation before it is accepted.

11546 Grain growth in three dimensions: a lattice model. Anderson, M.P.; Grest, G.S.; Srolovitz, D.J. (Exxon Research and Eng. Co., Annandale, NJ). *Scripta Metallurgica;* **19**: No. 2, 225-230(Feb 1985).

Grain growth is the term used to describe the increase in average grain size R which occurs upon annealing a polycrystalline aggregate after primary recrystallization is complete. In the long time limit, R increases with time t raised to a value n which is the growth exponent. Most existing grain growth theories implicitly assume that grains can be described as spherical and that growth occurs in an average environment. This, however, ignores the fact that adjacent grains share common boundaries, resulting in a microstructure that is topologically connected. These theories predict long term growth kinetics of the order n=1/2. Since experimental studies of grain growth yield an exponent less than 1/2, the discrepancy may be a consequence of neglecting topological constraints and the detailed environment. To examine this possibility a lattice model for 2-dimensional grain growth was developed in which topology and local environment are included. While this 2-dimensional model accurately simulates grain growth in thin encapsulated films, the validity of its predictions for 3-dimensional grain growth remains to be established. This paper reports the first results of our extension of the lattice grain growth model to 3 dimensions.

11547 The first sidebranch instability of dendritic structures. Somboonsuk, K.; Trivedi, R. (Ames Laboratory, USDOE and Department of Materials Science and Engineering, Iowa State University, Ames, Iowa). *Scripta Metallurgica;* **18**: No. 11, 1283-1286(Nov 1984).

Directional solidification studies have been carried out in succinonitrile-acetone system to study the location at which the first sidebranch perturbation occurs during the formation of dendritic structures. A scaling law of the form, λ /SUB p/ = 0.56 λ_1 λ_2 is found, which is independent of experimental conditions in the dendritic growth regime.

11548 Overload effect and fatigue crack propagation in amorphous metallic alloys. Chaki, T.K.; Li, J.C.M. (Department of Mechanical Engineering, University of Rochester, Rochester, NY). *Scripta Metallurgica;* **18**: No. 7, 703-708(Jul 1984).

Fatigue crack propagation in amorphous metals has an overload effect which usually increases with the number of overload cycles. The variation of overload effect with delta K is explained by the size of the plastic zone which depends on delta K. A comparison of the spacing between striations and da/dN shows that the crack jumps a step about every hundred cycles. The featureless region is probably due to shear fracture along a shear band during overload. Both crack tip blunting and branching occur during the application of overload. Work hardening is not a necessary factor for the overloading effect.

11549 Molecular dynamics studies of structural transformation in solids. Rahman, A. (Argonne National Lab., IL). *Materials Science Forum;* **1**: 211-222(1984).

Recent developments in the method of molecular dynamics simulation of solids and liquids make it possible to study the behavior of condensed systems under prescribed conditions of external stress. These developments are reviewed and compared with the more traditional molecular dynamics methods which have been used to study systems held at constant volume and shape. Examples are presented to show how these new methods have been used to study polymorphic transitions in various crystalline systems.

11550 Monte Carlo calculation of correlation and vacancy wind effects in diffusion. Murch, G.E. (Argonne National Lab., IL). *Materials Science Forum;* **1**: 199-210(1984). Contract W-31-109-ENG-38.

The calculation by Monte Carlo methods of the tracer correlation factor and vacancy wind effects in diffusion is described. The Einstein equation for the correlation factor and its generalization by Allnatt to the phenomenological coefficients are reviewed. In the latter case, such equations are compared directly with the external field equations for the Monte Carlo calculation of the Haven Ratio and vacancy-wind factors.

11551 Magnetohydrodynamic natural convection heat transfer from horizontal cylinders. Dunn, P.F. (Engineering Division, Argonne National Laboratory, Argonne, IL). *International Journal of Heat and Mass Transfer;* **26**: No. 9, 1413-1416(1983).

This study presents an approximate 2-dim. solution of magnetohydrodynamic (MHD) natural convection heat transfer from a finite cylinder at various orientations with respect to an applied magnetic field. The work is an extension of that of Lykoudis and Dunn, in which they measured and successfully predicted the MHD natural convection heat transfer from hot-film probes aligned axially with a horizontal magnetic field. The prediction of MHD heat transfer from a finite cylinder at various orientations with respect to an applied magnetic field is particularly useful in the determination of the heat transfer from a hot-film probe used in a single-phase liquid metal and two-phase liquid-metal inert-gas MHD studies. It also is relevant to the prediction of heat transfer in various fusion reactor blankets, such as those in which lithium flows through tubes immersed in pools of stagnant lithium or those involving natural circulation of a liquid metal. Detailed local measurements of the OHD (ordinaryhydrodynamic) and MHD natural convection heat transfer from horizontal finite cylinders to mercury for two magnetic field orientations have been presented by Michiyoshi et al. Average measurements of MHD natural convection heat transfer to mercury for the third mutually orthogonal magnetic field orientation have been presented by Dunn. These experimental studies and the analytical work of Lykoudis and Dunn are the bases of the present work.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 10779, 11024, 11225, 11361, 11487, 11527, 11546, 11568, 11597, 11675, 11757, 12115, 12396

11552 **(ANL/FE—85-9) Corrosion of ceramic refractories exposed to a synthetic coal slag by means of the rotating-drum technique.** Greenberg, S.; Poeppel, R.B. (Argonne National Lab., IL (USA)). Oct 1985. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005523.

A rotating-drum refractory/slag corrosion facility was designed to expose samples of commercial refractories to molten slag under controlled conditions of slag composition, temperature, oxygen partial pressure, slag feed rate, and the angle of inclination and rotational speed of the test section. Individual tests of a 90% Cr_2O_3-10% Al_2O_3 refractory and two different picrochromite refractories produced the same ranking of corrosion resistance as obtained from plant performance data and from the use of the rotating-cylinder test technique. However, when the two picrochromites were exposed simultaneously as alternating components of one test section, the one that had exhibited inferior resistance in individual tests showed the same resistance as the superior refractory. The implications of this anomalous effect are discussed. 6 refs., 1 fig., 6 tabs.

11553 **(BMI—2133) Multiaxial stress response of ceramics. Progress report, December 1, 1984-November 30, 1985.** Rosenfield, A.R.; Duckworth, W.H.; Shetty, D.K. (Battelle Memorial Inst., Columbus, OH (USA)). 13 Dec 1985. Contract FG02-84ER45073. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004530.

Research includes both room-temperature and high-temperature studies. Results on glass suggest differences in the shear sensitivity of failure strength between surface cracks and through cracks. Errors due to indentation were studied. (DLC)

11554 **(CEA-CONF—7779) Study of the thermal annealing of γ-irradiation effects in Al_2O_3: Mn.** Villedieu, M.; de Goer, A.M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Aug 1984. 2p. (CONF-840883—3-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750360.

From International conference on defects in insulating crystals; Salt Lake City, UT, USA (20 Aug 1984).

Published in summary form only.

11555 **(CONF-851217—15) Amorphization and recrystallization processes in monocrystalline beta silicon carbide thin films.** Edmond, J.A.; Withrow, S.P.; Kong, H.S.; Davis, R.F. (North Carolina State Univ., Raleigh (USA). Dept. of Materials Engineering; Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004797.

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

Individual, as well as multiple doses of $^{27}Al^+$, $^{31}P^+$, $^{28}Si^+$, and $^{28}Si^+$ and $^{12}C^+$, were implanted into (100) oriented monocrystalline β-SiC films. The critical energy of ≃16 eV/atom required for the amorphization of β-SiC via implantation of $^{27}Al^+$ and $^{31}P^+$ was determined using the TRIM84 computer program for calculation of the damage-energy profiles coupled with the results of RBS/ion channeling analyses. In order to recrystallize amorphized layers created by the individual implantation of all four ion species, thermal annealing at 1600, 1700, or 1800°C was employed. Characterization of the recrystallized layers was performed using XTEM. Examples of SPE regrown layers containing precipitates and dislocation loops, highly faulted-microtwinned regions, and random crystallites were observed.

11556 **(CONF-851217—21) Hardness of ion implanted ceramics.** Oliver, W.C.; McHargue, C.J.; Farlow, G.C.; White, C.W. (Oak Ridge National Lab., TN (USA); Wright State Univ., Dayton, OH (USA)). 1985. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004771.

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

It has been established that the wear behavior of ceramic materials can be modified through ion implantation. Studies have been done to characterize the effect of implantation on the structure and composition of ceramic surfaces. To understand how these changes affect the wear properties of the ceramic, other mechanical properties must be measured. To accomplish this, a commercially available ultra low load hardness tester has been used to characterize Al_2O_3 with different implanted species and doses. The hardness of the base material is compared with the highly damaged crystalline state as well as the amorphous material.

11557 **(CONF-8508153—1) Fourier-filtering techniques for the analysis of high-resolution pulsed neutron powder diffraction data.** Richardson, J.W. Jr.; Faber, J. Jr. (Argonne National Lab., IL (USA); Chicago Univ., IL (USA). Dept. of Geophysical Sciences). 1985. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004204.

From 34. annual Denver conference on applications of x-ray analysis; Snowmass, CO, USA (5 Aug 1985).

Rietveld profile refinements using high-resolution pulsed neutron powder diffraction data, collected at IPNS, often reveal broad intensity contributions from sources other than the crystalline materials being studied. Such non-crystalline intensity hampers standard Rietveld refinement, and its removal and/or identification is imperative for successful refinement of the crystalline structure. A Fourier-filtering technique allows removal of the non-crystalline scattering contributions to the overall scattering pattern and yields information about the noncrystalline material. In particular, Fourier transformation of residual intensities not accounted for by the Rietveld procedure results in a real-space correlation function similar to a radial distribution function (RDF). From the inverse Fourier transform of the correlation function a Fourier-filtered fit to the diffuse scattering is obtained. This mathematical technique was applied to data for crystalline quartz, amorphous silica, and to a simulated diffraction pattern for a mixture of the two phases. 7 refs., 4 figs., 1 tab.

11558 **(DOE/ER/45150—1) Analytical electron microscopy studies of precipitation in ceramic systems.** (Lehigh Univ., Bethlehem, PA (USA)). [1986]. Contract FG02-84ER45150. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005511.

Purpose of the proposed research is to gain an understanding of precipitation and solid state phase transformations in ceramic

systems with potential for improvement in properties through transformation toughening. AEM (analytical electron microscopy), CBED (convergent beam electron diffraction), and HREM (high resolution electron microscopy) are used as the major research techniques. During the next grant period we propose to: continue investigation on the ZrO_2-TiO_2-MgO ternary system, and to perform research concerning interfacial structure and microchemistry in zirconia-based eutectic systems. In addition, work performed during the present research year (1985-1986) is described, including completed research on precipitation in the Y_2O_3-La_2O_3 system.

11559 (SAND—84-1007) Potential effect of water influx on the dissolution rate of UO_2 in spent fuel at the Yucca Mountain, Nevada site. Braithwaite, J.W. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1985. Contract AC04-76DP00789. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005335.

This study identifies the potential effect of groundwater influx on the dissolution rate of uranium dioxide (UO_2) from spent fuel for expected conditions at a prospective site for the disposal of radioactive waste. The analysis is based on the hydrological characteristics of the unsaturated zone at Yucca Mountain, Nevada. Although conditions that could lead to inundation of the waste packages are improbable at the site, dissolution resulting from either complete or partial exposure of the spent fuel to water was considered. Estimates were made of the lower limit of water-contact time with the UO_2 in spent fuel under partially saturated conditions. If spent fuel is inundated, the dissolution rate of the UO_2 is constrained by its solubility limit. If partially saturated conditions exist, the uraniun dioxide leach rate could control the dissolution process. Under conditions of both partial or complete saturation, the dissolution rate of uranium is shown to be a linear function of the water influx. The practical application of the results of this study for determining radionuclide-release rates from spent fuel is also discussed.

11560 Silicon nitride joining. Mecartney, M.L.; Loehman, R.E.; Sinclair, R. (Stanford University, Stanford, California). *Journal of the American Ceramic Society;* **68**: No. 9, 472-478(Sep 1985).

Hot-pressed Si_3N_4 was joined using an MgO-Al_2O_3-SiO_2 glass composition chosen to approximate the oxide portion of the grain-boundary phase in the ceramic. After it has been heated at 1550° to 1650°C, the interface of the joined ceramic is an interlocking mixture of Si_2N_2O, β-Si_3N_4, and a residual oxynitride glass. The kinetics of reactions between Si_3N_4 and the molten joining composition were studied by X-ray diffraction analysis of the phases present in Si_3N_4 powder-glass mixtures quenched after varied heat treatments. Analytical transmission electron microscopy of the composition and microstructure of the reaction zone in joined specimens, together with the X-ray diffraction results, suggests that the driving force for joining is the lowering of the Si_3N_4 interfacial energy when it is wet by the molten silicate, augmented by the negative Gibbs energy for the reaction $SiO_2(\ell) + Si_3N_4 = 2Si_2N_2O$.

11561 Damage analysis of creep in bending. Rosenfield, A.R.; Duckworth, W.H.; Shetty, D.K. (Battelle Columbus Laboratories, Columbus, Ohio). *Journal of the American Ceramic Society;* **68**: No. 9, 483-485(Sep 1985).

A model of creep behavior is described in which the ratio of creep rate in tension to that in compression depends on stress. It is suggested that the difference in rates is due to preferential microstructural damage formation in tension. Among the consequences of the model are creep-rate/stress exponents in both tension and bending that increase with increasing stress, in accord with evidence reported in the literature.

11562 Ion channeling studies of $KTaO_3$:Nb. Dubus, M.; Daudin, B.; Salce, B.; Boatner, L.A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38, France. Service des Basses Temperatures; Oak Ridge National Lab., TN, USA). *Solid State Communications;* **55**: No. 8, 759-763(Aug 1985).

Ion channeling measurements have been performed on $KTaO_3$:Nb(KTN) in order to check the position of Nb relative to the tantalum site. No evidence for "off-center" Nb was found in the limit of experimental accuracy. In addition, the carbon content of the samples was measured and large concentrations were found (approx.= 300 p.p.m. weight). Possible relationship between Nb location and carbon presence is discussed.

11563 Formation of amorphous layers in Al_2O_3 by ion implantation. White, C.W.; Farlow, G.C.; McHargue, C.J.; Sklad, P.S.; Angelini, M.P.; Appleton, B.R. (Oak Ridge National Lab., TN). *Nuclear Instruments and Methods in Physics Research;* **B7/8**: 473-478(1985).

Conditions are described that can be used to turn the near-surface region of Al_2O_3 amorphous by ion implantation. Epitaxial recrystallization of the amorphous region during thermal annealing is demonstrated. Changes in the physical and structural properties as a result of implantation are correlated with changes in the mechanical properties (microhardness). 6 references, 4 figures.

11564 Substantial solid solutions of bismuth-containing lanthanide dititanates, Ln/sub 2-x/Bi/sub x/Ti_2O_7. Bamberger, C.E.; Dunn, H.W.; Begun, G.M.; Landry, S.A. (Oak Ridge National Lab., TN). *Journal of Solid State Chemistry;* **58**: 114-118(1985). Contract AC05-84OR21400.

The formation of solid solutions Ln/sub 2-x/Bi/sub x/Ti_2O_7, where Ln = La to Lu and Y, except Ce, Pm, and Eu, was studied by Raman spectroscopy and to a lesser extent by x-ray diffraction. It was established that the solubility of bismuth increases with decreasing ionic radius of the lanthanide element. No evidence was experimentally found in this work for the existence of Bi_2Ti_2O'. 9 references, 3 figures, 1 table.

11565 Removal of oxide contamination from silicon carbide powders. Brynestad, J.; Bamberger, C.E.; Heatherly, D.E.; Land, J.F. (Oak Ridge National Lab., TN). *Journal of the American Ceramic Society;* **67**: No. 9, C.184-C.185(Sep 1984). Contract AC05-84OR21400.

The removal of oxide (SiO_2) contamination from SiC powders by treatment with BCl_3(g) or with HF(g) has been demonstrated. Hydrogen fluoride is more effective and does not present corrosion problems with the container materials used. 6 references, 2 tables.

11566 Influence of anisotropy and doping on grain boundary diffusion in oxide systems. Stubican, V.S.; Osenbach, J.W. (Pennsylvania State Univ., University Park). *Solid State Ionics;* **12**: 375-381(1984). Contract AC02-78ER04998.

The grain-boundary diffusion product of Cr-51 in magnesium oxide and chromium-doped magnesium oxide as a function of grain-boundary orientation and point-defect concentration was determined at 1200 to 1450°C. A large degree of anisotropy was found in the grain boundary diffusion behavior of magnesium oxide. The results indicate that grain-boundary diffusion in magnesium oxide is connected to the orientation of dislocations and the mechanism is one of dislocation pipe diffusion. The grain-boundary diffusion product increased with increasing Cr concentration in magnesium and was approximately four times larger for magnesium oxide containing 0.56 at % Cr than for the undoped magnesium oxide. For all crystals studied, the activation energies are within 180+/-20 kJ/mol which is 60% of the activation energy for Cr-51 diffusion in undoped magnesium oxide.

11567 Irreversible effects in the FeTi-H system. Reilly, J.J.; Johnson, J.R.; Lynch, J.F.; Reidinger, F. (Brookhaven National Lab., Upton, NY). *Journal of the Less-Common Metals;* **89**: 505-512(1983). Contract AC02-76CH00016.

From International symposium on the properties and applications of metal hydrides; Toba, Japan (30 May 1982).

The equilibrium hydrogen absorption isotherm using annealed strain-free FeTi exhibits only one plateau up to a composition of FeTiH/sub 1.95/. However, the desorption isotherm exhibits the usual two plateaus. X-ray-diffraction results of samples with compositions within the absorption plateau limits indicate the major phases present to be α and γ, although a small amount of β phase was always detected. Apparently the absorption isotherm represents the direct $\alpha \rightarrow \gamma$ conversion and β phase precipitation is almost completely suppressed. The results are attributed to the influence of lattice strain upon the behavior of the β_1 and β_2 phases. A practical

consequence of the effect is the distortion of the pressure-composition isotherm in the β-γ region as a function of hydriding-dehydriding cycles. 10 references, 4 figures, 2 tables.

3603 Composite Materials

11568 **Fabrication of ceramic-ceramic composites by chemical vapor deposition.** Stinton, D.P.; Lackey, W.J.; Lauf, R.J.; Besmann, T.M. (Oak Ridge National Lab., TN). *Ceramic Engineering and Science Proceedings;* 5: 668-676(Jul-Aug 1984). Contract AC05-84OR21400.

Toughened ceramic composites were produced by the simultaneous chemical vapor deposition of two phases. Fracture toughness values were nearly double the value of SiC when CH_3SiCl_3 and $TiCl_4$ vapors were used to produce SiC-$TiSi_2$ composites. Other systems consisting of SiC and the metal or metal carbides of Ni, Cr, W, and Mo were examined. Equilibrium thermodynamic analyses of these systems were performed as a function of the chemical vapor deposition variables: temperature, total pressure, and reactant concentration. These calculations confirmed that the volatile species used early in this work (organometallic compounds of Ni and Cr and the fluorides of W and Mo) were not suitable for the production of toughened composites. Additional work is under way to produce composites from the oxychlorides or carbonyls of Ni and Cr or the chlorides or oxychlorides of W and Mo. Thermodynamic calculations also indicated that SiC and TiC should be co-deposited when CH_3SiCl_3, $TiCl_4$, and a hydrocarbon are used as the coating gases. Much additional work remains to produce SiC-TiC composites and to control the morphology of the $TiSi_2$ dispersed phase so that optimum fracture toughness values can be obtained. 24 references, 6 figures.

3604 Polymers And Plastics

11569 **(NUREG/CR—2150) Study of energy loss and its mechanisms in Homalite 100 during crack propagation and arrest.** Shukla, A.; Fourney, W.L.; Irwin, G.R. (Maryland Univ., College Park (USA). Photomechanics Lab.). Jun 1981. Contract AC05-84OR21400. 169p. (ORNL/Sub—7778/1). NTIS, PC A08/MF A01 - GPO. File Number TI85015978.

Energy balance concepts were used to determine the amount of energy lost due to damping in a run-arrest fracture event. Possible sources of damping were identified and experiments were conducted to determine their relative contribution to the overall damping. 16 refs., 89 figs., 13 tabs.

11570 **Dependence of radical anion stability on crystal structure.** Samskog, P.O.; Kispert, L.D. (Univ. of Alabama, Tuscaloosa). *Molecular Crystals and Liquid Crystals;* 107: 75-80(1984).

An INDO calculation using the RHF/CI method indicates that the minimum energy conformation of the $[XCH_2CONH_2]^-$ radical anions where X = F, Cl, Br and I occurs if the C-X bond is located in a direction approximately normal to the CON plane. It has been experimentally shown that for these radical anions to be observed in single crystals by EPR methods, the molecular precursor should not exist in the energy-maximum conformation for radical anions or else spontaneous elimination of X^- occurs upon electron attachment. This suggests that F^- elimination from dopants (e.g. AsF_5) used in the formation of conducting polymers may be a general phenomenon if the anion is formed from a maximum energy configuration. 13 references, 2 figures, 1 table.

3606 Other Materials

REFER ALSO TO CITATION(S) 11060, 11165, 11168, 11169, 11519, 11543, 11549, 11560, 12114, 12115

11571 **(AD-A—158759/1/XAB) Photoluminescent response of palladium-cadmium sulfide and palladium-graded cadmium sulfoselenide Schottky diodes to molecular hydrogen. Technical report.** Carpenter, M.K.; Van Ryswyk, H.; Ellis, A.B. (Wisconsin Univ., Madison (USA). Dept. of Chemistry). 15 Aug 1985. 13p. (UWIS/DC/TR—85/1). NTIS, PC A02/MF A01.

The bulk photoluminescence (PL) of Schottky diodes constructed from Pd and n-type CdS (Pd-CdS) and from n-type, graded CdS/sub x/Se/sub 1-x/ ($0 \leqq x \leqq 1$; x - 1 at surface) (Pd-CdS/sub x/Se/sub 1-x/) is sensitive to molecular H_2. For the Pd-CdS diode, exposure to H2 (3:1, N_2:H_2 mixture) significantly enhances the PL intensity of edge emission λ/sub max./$\sim$ 510 nm) relative to the intensity in air; using a dead-layer model, the corresponding reductions in depletion width and Schottky barrier height can be estimated. For the Pd-CdS/sub x/Se/sub 1-x/ diodes, H_2 changes the spectral distribution; PL from this material, color-coded to spatially resolve e^--H^+ pair recombination, indicates the depth over which the electric field is reduced in the semiconductor. These phenomena demonstrate optically-coupled chemical sensing of hydrogen.

11572 **(AD-A—158832/6/XAB) 30-MeV electron-beam irradiation effects on GaAs(1-x)P(x) LEDS (light emitting diodes). Master's thesis.** Foley, J.K. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1985. 98p. NTIS, PC A05/MF A01.

LEDs of the ternary alloy GaAs(.7)P(.3) were irradiated with a 30-MeV electron beam. The effects this exposure had on peak wavelength, absolute and relative light output intensities, and current-forward bias characteristics were studied. A simple model of LED current-controlling mechanisms is described, and a mathematical approach for deriving a descriptive damage constant is provided. Observed irradiation effects consisted of increased current and decreased light-output intensity for a given forward-bias voltage and indicate that the devices tested are an order of magnitude softer to electron radiation than results previously reported. Damage constants were calculated: group 9 (2.9×10^{-14} cm^2/e), group A5 (2.6×10^{-14} cm^2/e), and group 3 (1.4×10^{-14} cm^2/e). Shielded and un-shielded devices were compared to determine if the secondary electron production for bremsstrahlung losses would reduce the total fluence required for degradation. The results of this experiment were inconclusive. A procedure was developed to determine the electron beam current density for use in dose estimations. Electron doses were a factor of three higher when compared to the previous method of calculation.

11573 **(BNL—37301) Single-crystal neutron diffraction study of the distribution and thermal motion of silver ions in alpha- and beta-Ag_3SI.** Didisheim, J.J.; McMullan, R.K.; Wuensch, B.J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering; Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 14p. (CONF-850870—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005056.

From 5. international conference on solid-state ionics; Lake Tahoe, CA, USA (18 Aug 1985).

Single-crystal neutron diffraction data have been used to examine the distribution of mobile Ag^+ ions in anion-ordered β-Ag_3SI (space group Pm3m) and anion-disordered α-Ag_3SI (space group Im3m) at 8 temperatures in the overall range 23° to 475°C. The Ag density in the β-phase is confined to a cluster of four tetrahedral sites grouped at the centers of the cell faces, closely spaced as a result of the different distances between Ag^+ and the two species of anion. The individual sites are not resolved in Fourier syntheses because of large thermal displacements within a flat potential well, but the refinements permit rejection of occupancy of the octahedral site. The Ag^+ distribution in α-Ag_3SI displays a 2-coordinated site on the body diagonal of the cell and density delocalized in <100> bands which display fine structure not present in α-AgI or β-Ag_2S.

This feature may be qualitatively interpreted as an average over positional disorder of the equilibrium position within the tetrahedral interstice, the location depending on the short-range configuration of anions about the site. Models employing partial Ag^+ occupancy of the 2-coordinated position plus either octahedral or tetrahedral site occupancy involve the same number of structural parameters and refined to comparable levels. Tetrahedral site occupancy is judged to be somewhat more likely on the basis of agreement for the higher temperature data sets and physical criteria.

11574 **(CEA-CONF—7778) Thermal conductivity of neutron irradiated quartz.** de Goer, A.M.; Devismes, N.; Salce, B.; Laermans, C. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Aug 1984. 2p. (CONF-840883—4-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750361.

From International conference on defects in insulating crystals; Salt Lake City, UT, USA (20 Aug 1984).

Published in summary form only.

11575 **(CEA-CONF—7895) Direct spectroscopic observation of molecular hydrogen by high resolution proton NMR and a reinterpretation of the proton NMR spectra for amorphous Si:H.** Lamotte, B. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Jun 1984. 5p. (CONF-8406129—6). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750441.

From MRS European meeting; Strasbourg, France (5 Jun 1984).

It is possible to observe directly by NMR molecular hydrogen present in amorphous hydrogenated silicon. This is done with the help of a high resolution method using the Magic Angle Rotation of the sample, which gives specific high resolution spectra of the "narrow" line of the classical spectra. These new results lead us to give a modified interpretation of this "narrow" line of the proton NMR spectra.

11576 **(CONF-851217—22) Time-resolved reflectivity measurements of silicon and germanium pulsed excimer laser irradiation.** Jellison, G.E. Jr.; Lowndes, D.H.; Mashburn, D.N.; Wood, R.F. (Oak Ridge National Lab., TN (USA)). Nov 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02. File Number DE86004804.

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

Time-resolved reflectivity measurements of silicon and germanium have been made during pulsed KrF excimer laser irradiation. The reflectivity was measured simultaneously at both 1152 and 632.8 nm wavelengths, and the energy density of each laser pulse was monitored. The melt duration and the time of the onset of melting were measured and compared with the results of melting model calculations. For energy densities just above the melting threshold, it was found that the melt duration was never less than 20 ns for Si and 25 ns for Ge, while the maximum reflectivity increased from the value of the hot solid to that of the liquid over a finite energy range. These results, along with a reinterpretation of earlier time-resolved ellipsometry measurements, indicates that, during the melt-in process, the near-surface region does not melt homogeneously, but rather consists of a mixture of solid and liquid phases. The reflectivity at the onset of melting and in the liquid phase have been measured at both 632.8 and 1152 nm, and are compared with the results found in the literature.

11577 **(CONF-8510245—1) Use of computer simulation technique to study atomic migration in solids.** Vashishta, P. (Argonne National Lab., IL (USA)). Oct 1985. Contract W-31-109-ENG-38. 11p. NTIS, PC A02. File Number DE86004200.

From International conference on solid state ionics; Lake Tahoe, CA, USA (18 Oct 1985).

Nature of ionic motions in superionic conductors AgI and Ag_2S are studied using molecular-dynamics (MD) technique. Our model of these superionic conductors is based on the use of effective pair-potentials. To determine the constants in these potentials, cohesive energy and bulk modulus are used as input; in addition one uses notions of ionic size based on the known crystal structures. The $\alpha \rightleftharpoons \beta$ structural phase transition in AgI is studied with the use of the new molecular dynamics (NMD) technique which allows for a dynanical variation of the shape and size of the cell. In the present model, upon heating the β-AgI, the iodine ions undergo a hcp $\rightarrow$ bcc transformation and silver ions become mobile, whereas the reverse transformation is observed on cooling of α-AgI. The calculated $\alpha \rightleftharpoons \beta$ transition temperature, and structural and dynamical properties are in good agreement with experiments. It has also become possible to observe crystal growth of α and β phases when a system of molten AgI is cooled to different temperatures. Transition temperatures determined from the studies of $\alpha \rightleftharpoons \beta$ structural transitions and from crystal growth studies are in good agreement. The calculated transition temperatures are also in good accord with the experimental results. A model of superionic conductor Ag_2S is also studied. The silver density map and its temperature dependence is calculated. We have also calculated the x-ray and neutron structure factors which explain the anomalous intensity at and near Q = (1.6, 1, 0) observed in diffuse scattering experiments. A study of low-energy excitations in Ag_2S is in progress.

11578 **(DOE/ER/45078—1-1985) Local structure of metal atoms in silica and silicates. Progress report, May 15-December 1, 1985.** Garofalini, S.H. (Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Ceramics). Dec 1985. Contract FG05-84ER45078. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004998.

Goal of the research is aimed at developing a better understanding about the structural and dynamic properties of metal atoms in vitreous silica and at the vitreous silica surface. The major avenues of research have addressed: the structure of the vitreous silica surface and the effect of that structure on the adsorption behavior, structure, and mobility of atoms adsorbed onto the vitreous silica surface, and the local structure around zinc ions in zinc silicate glasses and sodium zinc silicate glasses and the effect of that structure on diffusion.

11579 **(DOE/ER/45168—2) Investigations of hard, carbon-based surface coatings: from "diamond-like" carbon to silicon carbide. Progress report, July 1, 1985-June 30, 1986.** Smith, F.W. (City Coll., New York (USA). Dept. of Physics). Jan 1986. Contract FG02-84ER45168. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005141.

Results obtained during the preceding twelve months (January-December, 1985) from the experimental studies of hard, carbon-based surface coatings are presented. A study of the optical constants of a dc glow discharge-prepared carbon-rich hydrogenated amorphous silicon-carbon alloy film (a-Si/sub 1-x/C/sub x/:H, x $\sim$ 0.87) has been completed. The results obtained are consistent with enhanced tetrahedral coordination for the carbon atoms and demonstrate improved thermal stability for this silicon-carbon alloy film as compared to an hydrogenated amorphous film containing only carbon. Subsequently, in our newly-constructed rf glow discharge system, we have prepared and determined the optical constants of a series of alloy films spanning the concentration range from pure carbon (a-C:H) to pure silicon (a-Si:H). A tetrahedron-based model is being developed to help correlate the local order present in the films with their measured optical constants.

11580 **(IC—85/21) Ion model and dipole polarizabilities in energy calculations.** Islam, A.K.M.A. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1985. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700481.

The present paper comments on the work of Guido and Gigli and investigates the applicability of the ion model and dipole polarizabilities to the alkaline earth monosulphides utilizing new theoretical and experimental information.

11581 **(IFUSP-P—474) Transitions in a lyomesophase: a study by thermal analysis and electron microscopy.** Amaral, L.Q. do. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700354.

The system Na decyl sulfate/water/decanol/Na sulfate, which forms a disc nematic phase N sub(L) at room temperature, has been studied by differential scanning calorimetry (DSC) and by

electron microscopy (EM). DSC reveals three first order phase transitions at 0°C, 12°C and 24°C. Latent heats show that the first transition must involve other processes besides the fusion of water, while the last one between a coagel CG phase and N sub(L) may be atributed to the order-disorder transition of the hydrocarbon chains (Krafft melting). Freeze-etching replicas have been obtained from samples initially in N sub(L) and CG phases. Results obtained from N sub(L) phase show disc structure of about 2000 A. Results obtained from CG phase show large lamellar structures and zones of transition to the disc structures.

11582 (IFUSP-P—496) Phosphorescence in irradiated spodumene. Fujii, A.T.; Isotani, S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700357.

Kinetics of phosphorescence in ^{60}Co γ-rays irradiated spodumene with low [Mn]/[Fe] ratio is determined. It is interpreted through the Adirowitch's kinetic model in which trapped electrons are liberated thermally and are retrapped or captured by luminescent centres.

11583 (LBL—20627) Transient and temperature-dependent phenomena in Ge:Be and Ge:Zn far infrared photoconductors. Haegel, N.M. (Lawrence Berkeley Lab., CA (USA)). Nov 1985. Contract AC03-76SF00098. 120p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86005191.

An experimental study of the transient and temperature-dependent behavior of Ge:Be and Ge:Zn photoconductors has been performed under the low background photon flux conditions (p dot ≅ 10^8 photons/second) typical of astronomy and astrophysics applications. The responsivity of Ge:Be and Ge:Zn detectors is strongly temperature-dependent in closely compensated material, and the effect of compensation on free carrier lifetime in Ge:Be has been measured using the photo-Hall effect technique. Closely compensated material has been obtained by controlling the concentration of novel hydrogen-related shallow acceptor complexes, A(Be,H) and A(Zn,H), which exist in doped crystals grown under a H_2 atmosphere. A review of selection criteria for multilevel materials for optimum photoconductor performance is included. 55 refs., 47 figs.

11584 (ORNL—6242) Modeling of complex melting and solidification behavior in laser-irradiated materials [a description and users guide to the LASER8 computer program]. Geist, G.A.; Wood, R.F. (Oak Ridge National Lab., TN (USA)). Nov 1985. Contract AC05-84OR21400. 94p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86004661.

The conceptual foundation of a computational model and a computer program based on it have been developed for treating various aspects of the complex melting and solidification behavior observed in pulsed laser-irradiated materials. A particularly important feature of the modeling is the capability of allowing melting and solidification to occur at temperatures other than the thermodynamic phase change temperatures. As a result, interfacial undercooling and overheating can be introduced and various types of nucleation events can be simulated. Calculations on silicon with the model have shown a wide variety of behavior, including the formation and propagation of multiple phase fronts. Although originally developed as a tool for studying certain problems arising in the field of laser annealing of semiconductors, the program should be useful in treating many types of systems in which phase changes and nucleation phenomena play important roles. This report describes the underlying physical and mathematical ideas and the basic relations used in LASER8. It also provides enough specific and detailed information on the program to serve as a guide for its use; a listing of one version of the program is given.

11585 (SAND—83-1293) Observations regarding the stability of bentonite backfill in a high-level waste (HLW) repository in rock salt. Krumhansl, J.L. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1986. Contract AC04-76DP00789. 101p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86005334.

Consideration of bentonite as a component of the engineered barrier system surrounding high-level nuclear waste (HLW) canisters in rock salt raised several questions regarding the stability of this clay. Dehydration studies pertinent to the period immediately following waste emplacement showed a partial loss in swelling ability, the extent of which depended on the composition of the rehydrating brine and increased with temperature from 150° to 320°C. At a later date, hydrothermal reactions between brine and bentonite may occur as pressure in the repository rises and the backfill saturates with brine. In pure sodium chloride brines little change in the bentonite was observed after two months at 250°C. In the same amount of time, brines rich in potassium formed mixed-layer, illite-smectite clays. Adding magnesium to the brine arrested mixed-layer clay formation; instead, a magnesium-enriched montmorillonite formed and the brine pH dropped. Radiation stability studies to 10^{10} rads were conducted in both wet and dry environments, but caused no detectable alteration of the clay. In contrast, fluid-phase compositions changed significantly. Gamma irradiation of dry bentonite produced an oxygen-depleted atmosphere which was enriched in both hydrogen and carbon dioxide. Mixed bentonite-brine slurries produced copious amounts of both hydrogen and oxygen gas when irradiated. These irradiated slurries generally had posttest pH values between 4 and 6. Solutions made by exposing preirradiated salt and bentonite to unirradiated water, or brine, had pH values between 6 and 8.5 and, in the case of salt solutions, were highly oxidizing. Although more research is needed for a complete performance assessment, it appears that such backfills may prove useful in a variety of rock-salt environments.

11586 (SAND—85-1425C) Pressure-dependent magneto-optic measurements in strained-layer superlattices at low temperatures. Jones, E.D.; Schirber, J.E.; Fritz, I.J.; Gourley, P.L.; Biefeld, R.M.; Dawson, L.R.; Drummond, T.J. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-851217—20). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004604.

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

Magneto-optic studies on InGaAs/GaAs and GaAs/GaPAs strained-layer superlattices are used to determine the in-plane light-hole valence-band effective masses. Also, hydrostatic pressure-dependent magneto-optic studies have been performed on these samples for magnetic fields up to 65 kG and pressures to 4 kbar in the temperature range of 1.6 to 4 K. The experimental pressure coefficients of the band-gap energy and the effective mass in the InGaAs/GaAs SLS structures were determined.

11587 (SAND—85-2606C) Effects of thermal donor generation and annihilation upon oxygen precipitation. Hahn, S.; Shatas, S.C.; Stein, H.J. (Siltec Corp., Mountain View, CA (USA); Peak Systems, Fremont, CA (USA); Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 8p. (CONF-851217—23). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004987.

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

Rapid thermal annealing and furnace annealing steps have been combined to investigate the effects of thermal donor generation and annihilation upon oxygen precipitation in low- and high-carbon silicon wafers. Thermal donors were formed by furnace annealing at 450°C. Rapid thermal annealing was performed in 10 second periods at temperatures between 600 and 1000°C and was followed by two-step furnace annealing at 700 and 950°C. Rapid thermal annealing separates the annealing stage for thermal donor removal from that for removal of oxygen precipitate nuclei, and a marked dependence upon carbon is observed for nuclei stability under RTA. Implications of these observations for models of precipitate nuclei are considered.

11588 (SAND—85-2664C) Optical imaging of dislocations in strained-layer superlattices and lattice-mismatched epilayers. Gourley, P.L.; Biefeld, R.M.; Dawson, L.R. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-851217—16). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004620.

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

We have developed a convenient photoluminescence microimaging technique to probe misfit dislocations in epitaxially grown semiconductor alloys and multilayers. Using this technique, we have examined the microscopic optical quality of thick (~1 μm) III-V semiconductor epitaxial layers, mismatched to their substrates. The layers include several kinds of [100] strained-layer superlattices (GaP/GaAs/sub x/P/sub 1-x/ on GaP and GaAs/GaAs/sub 1-x/P on GaAs grown by MOCVD, and GaAs/In/sub x/Ga/sub 1-x/As on GaAs grown by MBE) and associated alloys. For each type of superlattice, we have studied a large number of samples corresponding to different compositions and layer thicknesses. The results show that misfit dislocations can be completely eliminated in the uppermost layers of the strained-layer superlattices if these structures have thin layers, less than the critical thickness for elastic accommodation, and sufficient numbers of interfaces to block threading dislocations.

11589 **(SERI/STR—211-2789) Electrodeposition of p-CdTe and CdS/CdTe heterojunction devices. Final subcontract report, September 1983-May 1985.** Rajeshwar, K. (Texas Univ., Arlington (USA). Dept. of Chemistry). Sep 1985. Contract AC02-83CH10093. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016878.

The two primary tasks of this research were to fabricate and characterize p-type CdTe thin films by the cathodic electrodeposition technique and to fabricate efficient n-CdS/p-CdTe heterojunction devices using electrodeposited p-CdTe thin films. Past difficulties in electrodeposition involved the in situ fabrication of p-type CdTe thin films by cathodic electrodeposition; n-type material formed more readily than p-type. Some researchers applied post-deposition thermal treatment to induce n to p conversion. This research was conducted to devise suitable chemistry and electrochemistry whereby in situ deposition of p-type material could be induced (a) by increased Te loading of the electrodeposition bath, and (b) by suitable acceptor doping of the electrodeposited material. Both As and Cu were evaluated as dopants; As was found to be more suitable. Inverted structures were fabricated from the p-type CdTe thin films. The best AMl efficiencies achieved to date have been around 5%. Further improvements will depend on solving the problem of high series resistance.

11590 **Photothermal investigation of transport in semiconductors: Theory and experiment.** Fournier, D.; Boccara, C.; Skumanich, A.; Amer, N.M. (Applied Physics and Laser Spectroscopy Group and Center for Advanced Materials, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **59**: No. 3, 787-795(1 Feb 1986). Contract AC03-76SF00098.

The photothermal deflection technique has been extended as a contactless, in situ method to investigate transport in solids with an emphasis on semiconductors. A theoretical model is developed which quantitatively describes the transport behavior, and is shown to be in excellent agreement with experimental results. For semiconductors, this approach yields the thermal diffusivity, the electronic diffusivity, the minority-carrier lifetime and the surface recombination velocity.

11591 **Dipole activity of surface phonons on Si(111)2 x 1.** Alerhand, O.L.; Allan, D.C.; Mele, E.J. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104-3859). *Physical Review Letters;* **55**: No. 24, 2700-2703(9 Dec 1985). Contract FG02-84ER45118.

We report studies of the lattice dynamics and one-phonon absorption spectrum for the π-bonded-chain model of Si(111)2 x 1. The surface conductivity is dominated by a localized mode near 50 meV associated with a longitudinal optical phonon on the surface chains which is coupled to charge fluctuations in the electronic surface states. The dipole activity of this feature is anomalously strong and, interestingly, polarized parallel to the surface, along the chain direction. The dipole activity polarized normal to the chains is also presented.

11592 **Comment on "High-resolution scanning-ion-microprobe study of graphite and its intercalation compounds".** Bretz, M.; Clarke, R. (Department of Physics, The University of Michigan, Ann Arbor, Michigan 48109). *Physical Review Letters;* **55**: No. 22, 2506-2506(25 Nov 1985). Contract FG02-84ER45059.

A Comment on the Letter by R. Levi-Setti et al., Phys. Rev. Lett. 54, 2615 (1985).

11593 **Momentum distribution of ^{3}He.** Mook, H.A. (Solid State Division, Oak Ridge Natioanl Laboratory, Oak Ridge, Tennessee 37831). *Physical Review Letters;* **55**: No. 22, 2452-2454(25 Nov 1985). Contract AC05-84OR21400.

S(Q,E) has been obtained for liquid ^{3}He for Q values between 4 and 7 A^{-1} at temperatures of 1.2 and 0.37 K. The higher-temperature data are useful in examination of the role of final-state effects on measurements of S(Q,E). Fermi-liquid properties can be determined from the low-temperature results and the data are consistent with a Fermi temperature of 1.8 +- 0.2 K.

11594 **Dose rate dependence of damage clustering during heavy ion irradiation in Si.** Holland, O.W.; Fathy, D.; Narayan, J.; Oen, O.S. (Oak Ridge National Lab., TN, USA). *Radiation Effects;* **90**: No. 1-2, 127-139(Sep 1985).

The influence of dose rate on damage accumulation during heavy ion irradiation in Si was investigated. Combined analysis techniques including Rutherford backscattering/channeling spectrometry (RBS) and transmission electron microscopy (TEM) were used to characterize the nature and amount of residual damage. For room temperature irradiations, the amount of residual damage increased with increasing dose rate over the entire range investigated. However, no dependence was observed for cryogenic irradiations. These results are shown to be in good agreement with a model which assumes that damage is nucleated homogeneously.

11595 **Magnetic order in the TMTSF family of organic superconductors.** Kwak, J.F.; Azevedo, L.J. (Sandia National Labs., Albuquerque, NM, USA). *Comments on Solid State Physics;* **11**: No. 6, 245-255(Jun 1985).

The paper discusses the insulating spin density wave ground state, which occurs in many of the TMTSF family of organic superconductors. The magnetically ordered state associated with the metallic state in high magnetic fields, is also examined.

11596 **Dose rate effects in silicon during heavy ion irradiation.** Holland, O.W.; Fathy, D.; Narayan, J.; Oen, O.S. (Microelectronics Center of North Carolina, Research Triangle Park, USA; Oak Ridge National Lab., TN, USA. Solid State Div.). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 565-568(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Mechanisms for damage nucleation in Si during heavy ion irradiation are discussed. The influence of dose rate on the accumulation of damage is shown to be dependent upon the mass of implanted ions. For a constant fluence, it was found that damage increases with dose rate for all ions studied, although the effect was consistently smaller as the mass of the ion was increased. The systematic change is interpreted to indicate the increasing importance of cascade effects on damage nucleation as the mass of the ion increased. However, the large influence of dose rate for lighter ions is an indication of a different mechanism for damage nucleation, one which does not depend on cascade effects and is more homogeneous in nature.

11597 **Channeling-radiation measurements at Lawrence Livermore National Laboratory.** Berman, B.L.; Dahling, B.A.; Datz, S.; Kephart, J.O.; Klein, R.K.; Pantell, R.H.; Park, H. (Lawrence Livermore National Lab., CA, USA; Oak Ridge National Lab., TN, USA; Stanford Univ., CA, USA. Dept. of Electrical Engineering). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 611-617(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as report UCRL--91043; CONF-841117--8.

In the last few years, the amount and quality of channeling-radiation data have increased enormously, owing largely to much improved experimental capabilities. Current results include improved interplanar potentials for diamond, the description of the effect of platelets in diamond as an average thermal vibration, an improved determination of the Debye temperature of silicon, an improved determination of the thermal-vibration amplitude of LiD, and the demonstration that LiF crystal structures can survive intense electron bombardment.

11598 **Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs.** Sieber, K.D.; Sanchez, C.; Turner, J.E.; Somorjai, G.A. (Lawrence Berkeley Lab., CA). *Materials Research Bulletin;* **20**: No. 2, 153-162(1985). Contract AC03-76SF00098.

Sintered discs of magnesium substituted iron oxides have been prepared by gel routes or classical solid state reaction techniques and their crystallographic, electrical, and photoelectrochemical properties examined. The discs, sintered between 1200 and 1400°C for 20 hours, contain both α-Fe_2O_3 and a spinel phase. The electrical properties of the discs have been correlated with spinel concentration, the electrical resistivity decreasing with increasing spinel content. The materials were found to be consistently n-type by Seebeck voltage measurements. Photoelectrochemical measurements in aqueous solution showed, however, that the sintered disc electrodes exhibit photocathodic currents that are characteristic of p-type semiconductors. Evidence is presented which suggests that inhomogeneities in the near surface region of the discs are responsible for the observed photoelectrochemical properties.

11599 **Pulsed-laser annealing effects in Si.** Larson, B.C. (Oak Ridge National Lab., TN). *Comments on Solid State Physics;* **11**: No. 4, 151-177(1984). Contract AC05-84OR21400.

Experimental efforts to determine the annealing mechanism have included post-processing studies of damage removal and dopant diffusion by transmission electron microscopy (TEM), ion backscattering, secondary ion mass spectrometry (SIMS), and electrical measurement. In addition, real-time optical reflectivity and transmission, Raman scattering, electrical conductivity, particle emission, and x-ray scattering measurements have been brought to bear on the subject. The measurements, in general, support the thermal melting model of laser annealing with the exception of the time-resolved Raman scattering which have been interpreted in terms of the plasma model. Here the author discusses the developments that have led to the present understanding of laser annealing and outlines some of the remarkable materials processing and surface modification properties associated with pulsed-laser processing. As work on silicon has played a central role in the development of this area, this discussion concentrates on silicon although work on germanium and other semiconductors has been performed as well. 67 references, 10 figures, 1 table.

11600 **Enhanced diffusion from interstitial trapping during solid-phase-epitaxial growth of silicon alloys.** Pennycook, S.J.; Narayan, J.; Holland, O.W. (Oak Ridge National Lab., TN). *Journal of Crystal Growth;* **70**: 597-601(1984). Contract AC05-84OR21400.

During the recrystallization by solid-phase-expitaxial (SPE) growth of supersaturated silicon alloys, a high concentration of interstitials is trapped. These are released by subsequent heating causing a transient (greatly enhanced) diffusion of the substitutional dopant by an interstitialcy mechanism. The enhancement may be as much as five orders of magnitude over tracer values, and shows an activation energy of only 1.8 +/- 0.2 eV. Following the transient, the interstitials condense into loops, allowing an independent estimate to be made of their concentration. From these observations, it is proposed that during ion implantation, a fraction of the implanted dopants can acquire their natural valency, and retain it as the crystallization interface passes. For group V dopants this creates the trapped interstitials, giving transient enhanced diffusion when they are released by subsequent annealing. 12 references, 6 figures.

11601 **Structure of 3,4;3',4'-bis(ethylenedithio)-2,2',5,5'-tetrathiafulvalent-tetrabromoindate (2:1), $(BEDT\text{-}TTF)_2InBr_4$, $(C_{10}H_8S_8)_2InBr_4$.** Beno, M.A.; Cox, D.D.; Williams, J.M.; Kwak, J.F. (Argonne National Lab., IL). *Acta Crystallographica, Section C: Crystal Structure Communications;* **C40**: 1334-1337(1984). Contract W-31-109-ENG-38;AC04-76DP00789.

The crystal parameters of the title compounds are presented. The structure consists of dimerized stacks of BEDT-TTF ($C_{10}S_8H_8$) molecules separated by sheets of tetrahedral $InBr_4^-$ anions. Different and short contacts occur normal to the molecular-stacking direction for the two independent BEDT-TTF molecules. Short anion-sulfur non-binding contacts, and dimerization of the BEDT-TTF molecules within the stacks, may be responsible for this behavior. An activated conductivity with a room-temperature value of 0.05-0.5 $Omega^{-1}\,cm^{-1}$ is observed along the needle axis.

40 CHEMISTRY

REFER ALSO TO CITATION(S) 12268

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 10801, 10983, 11097, 11101, 11106, 11107, 11108, 11645, 11646, 11647, 11648, 11672, 11720, 11721, 11963

11602 **(AD-A—158387/1/XAB) Determination of gaseous hydrogen sulfide by cathodic stripping voltammetry after preconcentration on a silver metalized porous membrane electrode.** Opekar, F.; Bruckenstein, S. (State Univ. of New York, Buffalo (USA). Dept. of Chemistry). Jul 1984. 6p. NTIS, PC A02/MF A01.

Gaseous H_2S is accumulated on the surface of a porous silver membrane electrode at constant potential and directly determined by cathodic stripping voltammetry. The sensitivity of the method, expressed by the slope of the regression line for the dependence of the stripping peak current on the amount of H_2S in the gas sample, is 357 micrograms of H_2S/micro Amps. The reproducibility of the determination expressed in terms of the relative standard deviation is 3.2%. Phenomena observed during cathodic polarization of the silver porous membrane electrode, either clean or covered with deposited Ag_2S, are briefly discussed and the resultant conditions for optimal analysis are given.

11603 **(AD-A—158772/4/XAB) Aspects of high-resolution gas chromatography as applied to the analysis of hydrocarbon fuels and other complex organic mixtures. Volume 2. Survey of sample-insertion techniques. Final report, January-September 1980.** Rubey, W.A.; Dirkes, W.E. (Dayton Univ., OH (USA). Research Inst.). Jun 1985. 48p. (UDR-TR—83-97-VOL-2). NTIS, PC A03/MF A01.

Special attention needs to be given to the sample injection process in high-resolution gas chromatography (HRGC). For the analysis of highly complex organic mixtures, such as turbine engine fuels and various hydrocarbon feed stocks, the sample-insertion process is especially important. Presently, it is this admitting of sample to an HRGC system that most seriously limits the chromatographic analysis. Many different procedures have been used for injecting samples into an open tubular-column gas chromatograph with the use of microliter syringes. These many procedures can be grouped into four classifications known as: the split, the direct, the splitless, and the on-column injection procedure, respectively. These four types of injection procedures were surveyed and evaluated with respect to idealized injection practice, solute overloading, use of injector inserts and precolumns, fast-injection procedures, and various methods for focusing inserted solute zones. In view of the importance of sample insertion in HRGC, improved sample insertion procedures are under development. Also, recommendations are presented for obtaining adequate insertion of highly complex and undiluted hydrocarbon mixtures with HRGC systems.

11604 **(CEA-CONF—7704) Preliminary separation of the lanthanide group using DHDECMP.** Kwinta, J.; David, P.; Metzger, G. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Dec 1984. 15p. (CONF-841210—28). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750384.

From International chemical congress of Pacific Basin Society; Honolulu, HI, USA (16 Dec 1984).

The extraction procedure of rare earth elements from complex solutions requires many separation steps, due to the high number of elements involved. Dihexyl-N,N-Diethylcarbamylmethylene phosphonate (DHDECMP) has been proved to be a very selective extractant for lanthanides and actinides. Therefore it is interesting to test such an extractant with solutions obtained by the dissolution of solid samples. The DHDECMP properties in regard to rare earths are presented and a new procedure for their separation is defined.

11605 **(CEA-CONF—7705) Process for the recovery of americium from analytical wastes.** Brossard, P.; Kwinta, J.; Schwander, Y. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Dec 1984. 17p. (CONF-841210—27). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750383.

From International chemical congress of Pacific Basin Society; Honolulu, HI, USA (16 Dec 1984).

The object of the present work is to define a procedure for the extraction of americium contained in hundreds of liters of liquid analytical wastes. The main objective is to produce wastes for which the americium concentration is lower than 0,5 mg/l, the operations being carried out in glove boxes. Dihexyl N, N-diethylcarbamylmethylene phosphonate (DHDECMP) is used for the extraction of americium. Experimental laboratory results and procedure design are described. Distribution coefficient, DHDECMP concentration, addition of TBP, influence of PH and temperature are studied. A bank of mixer-settlers appears to be the most appropriate laboratory equipment to handle large volume of solution with a good efficiency.

11606 **(CEA-CONF—7706) Actinide-lanthanide group separation using sulfur and nitrogen donor extractants.** Musikas, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Dec 1984. 26p. (CONF-841210—29). NTIS (US Sales Only), PC A03/MF A01. File Number DE86750386.

From International chemical congress of Pacific Basin Society; Honolulu, HI, USA (16 Dec 1984).

Trivalent actinide-lanthanide group separation is difficult to perform on the industrial scale, because of the many drawbacks of the available chemical processes. This paper surveys the basic research investigations undertaken at Fontenay to find new extractants for 5f - 4f trivalent ion group separations. Valid alternatives to TALSPEAK and TRAMEX processes are potentially available to separate trivalent actinide from lanthanide without the need for inorganic salts. However some improvements are still necessary for example: HDEHDTP is moderately stable and other sulfur donor with higher chemical stability will be welcomed, $TPTZH^{+}$ and $TPTZH^{3+}{}_{2}$ are too hydrophilic and an actinide lanthanide group separation by TPTZ flowsheet should included a TPTZ recovery step.

11607 **(CEA-CONF—7776) Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinides elements.** Madic, C.; Bourges, J.; Koehly, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Jun 1984. 24p. (CONF-8406123—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750381.

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

Ten years ago the extraction chromatographic technique was developed for preparative purposes and is now applied for all chemicals separations needed for the production of actinides isotopes. That technique appears to be simple and flexible. It can be used for the production of microgram to kilogram amounts of actinide isotopes. This paper focuses on the experience gained and describes some peculiar production of actinide isotopes solved by using extraction chromatographic technique. After a review of extracting molecules and equipment, treatment of irradiated targets (preparation of Pu 238 and removal of neptunium, production of Am 243 and Cm 244), recovery of actinides from alpha aqueous wastes (preparation of Am 241) and recovery of decay products from aged actinide stocks (recovery of Am 241 from Pu stocks, of U 234 from Pu 238 stocks) are described.

11608 **(CONF-8511140—1) Surface-enhanced Raman spectroscopy: a new tool for chemical detection.** Vo-Dinh, T.; Ferrell, T.L.; Callcott, T.A.; Arakawa, E.T. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004795.

From Chemical defense conference; Aberdeen Proving Ground, MD, USA (19 Nov 1985).

This paper describes the development of a new spectrochemical tecnique based on Surface-Enhanced Raman Spectrometry (SERS) for sensitive detection of organic chemicals. One type of substrate for SERS analysis consists of cellulosic substrates covered with silver-coated teflon microspheres. The second type of SERS-active substrate is based on thermally etched quartz plate having prolate SiO_2 posts coated with silver. The results indicate that SERS technique shows great promise as a useful tool for trace organic detection. 9 refs.

11609 (DOE/ER/10565—10, pp 72-73) **Activation analysis.** Friedli, C.; Schweikert, E.A. (Institut d'Electrochimie et Radiochimie, Lausanne, Switzerland). Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

Work was pursued on the possibilities of trace determination with ^{7}Li, ^{9}Be, and ^{10}B ion beams. Both ^{7}Li and ^{10}B induced radioactivation were applied for trace determination of hydrogen via the $^{1}H(^{7}Li,n)^{7}Be$ and $^{1}H(^{10}B,\alpha)^{7}Be$ reactions. In both cases, boron and magnesium present nuclear interferences, but their extent does not exceed 0.5%. At the bombarding energies used (21 MeV $^{7}Li^{++}$ and 27 MeV ^{10}B), the detection limits are respectively 2 and 0.5 ppm of hydrogen in an iron matrix irradiated for two hours. Due to the recoil of ^{7}Be, the samples were carefully prepared to avoid superficial hydrogen contamination. A series of samples with hydrogen contents ranging from 15 to 120 ppm were examined. The results obtained with both activating beams are in good agreement. The possibilities of using a 14 MeV $^{9}Be^{++}$ ion beam to determine traces of boron, oxygen, and silicon in solids via the $^{10}B(^{9}Be,n)^{18}F$, $^{16}O(^{9}Be,p)^{24}Na$, and $^{28}Si(^{9}Be,t)/sup\ 34m/Cl$ reactions have also been tested. Potential nuclear interferences, identified by calculating the threshold energy and the Coulomb barrier of any reaction with ^{9}Be on neighboring elements of B, O, and Si, were checked by irradiating pure metallic foils or pellets of compounds of well known stoichiometry.

11610 **(DOE/ER/13329—1) Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations.** Doherty, M.F. (Massachusetts Univ., Amherst (USA). Dept. of Chemical Engineering). 1985. Contract FG02-85ER13329. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005015.

New techniques are being developed to aid in the design and synthesis of multicomponent, nonideal and azeotropic separation systems. The technique being developed is based on the concept of a residue curve map. These maps represent the fundamental phase-equilibrium behavior of the mixture in a way which is uniquely suited for separation-system studies. The maps provide information for discriminating between feasible and infeasible column sequences. New design tools have also been developed for calculating such quantities as minimum reflux ratios for azeotropic mixtures. In this report, new techniques are presented for analyzing heterogeneous azeotropic distillations. This research is in line with the proposed work described in the original grant proposal. The ultimate aim of this research program is to develop a comprehensive body of theory which will result in automatic computer procedures for synthesizing optimal separation sequences for multicomponent azeotropic mixtures. 10 refs., 3 figs.

11611 (DP—1713) Analysis of special recovery samples by Pu(III) spectrophotometry. Van Hare, D.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Nov 1985. Contract AC09-76SR00001. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005337.

A simple spectrophotometric method has been developed to determine the plutonium concentration of FB-Line Special Recovery samples. The method is applicable over the 1 to 150 g/L range, with an accuracy and precision of better than 1%. 9 refs., 3 figs., 3 tabs.

11612 (IAEA-TECDOC—337, pp 75-84) Ion exchange characteristics of hydrous oxides and their use in the separation of uranium and thorium. Misak, N.Z.; Salama, H.N.; Mikhail, E.M.; El-Naggar, I.M.; Petro, N.; Ghoneimy, H.F.; Shafik, S.S. (Atomic Energy Establishment, Cairo (Egypt)). Jul 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463. (CONF-8406123—).

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

The ion exchange characteristics of several hydrous oxides have been studied. The kinetic studies done with zirconia and ceria have shown that the increase of the charge of cations has a minor effect on their mobility in the exchangers while the increase of charge or complexing ability of the anions decreases their mobility. A dehydration of the cations is deduced. The mobility of cations and anions decreases the presence of alcohols. For alkali cation exchange, it was deduced from thermodynamic data on hydrous zirconia and ceria that the Eisenman model is qualitatively, and sometimes quantitatively, applicable, and that it can be used for obtaining successful predictions of the trends in the thermodynamic functions. This is not the case with anion exchange. The thermodynamic studies on hydrous zirconia in methanolic solutions show that the cation and anion exchange selectivity constants can be, at least in certain cases, predicted from the values in the aqueous media by considering ion-solvent interactions. However, even in these cases large changes occur in the solid phase. The physicochemical properties (acidity, capacity and porous texture) of hydrous oxides have a profound effect on their ion exchange behaviour. Besides, water structure effects seem to be of great importance in the case of alumina. The decrease of porosity and pore size seems to lead to the increase of hydrous oxide selectivity. Sorption studies of uranium and thorium from aqueous solutions on hydrous ceria and from both aqueous and mixed-solvent media on hydrous tin oxide point to the possibility of the use of hydrous oxides for the separation of uranium and thorium from each other and from other elements.

11613 (IAEA-TECDOC—337, pp 157-171) Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinide elements. Madic, C.; Bourges, J.; Koehly, G. (Section des Transuraniens, Institut de Recherche Technologique et de Developpement Industriel, CEA Centre d'Etudes Nucleaires, Fontenay-aux-Roses (France)). Jul 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463. (CONF-8406123—).

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

An extraction chromatographic process has been developed for the recovery of actinide elements (^{242}Cm, ^{241}Am, ^{238}Pu, ^{237}Np, ^{234}U and others) from irradiated targets, from alpha liquid wastes and from aged actinide stocks. An inorganic adsorbent can be used as a stable, inert support for an inorganic extractant, e.g., TBP- impregnated silica. Due to the large variety of organic extractants available, this technique can be applied successfully to solve difficult actinide separations in quantities ranging from micrograms to kilograms. A comparison of extraction chromatography is also made with resin chromatography and liquid-liquid extraction.

11614 (INFO—0128-1) Techniques of sample attack used in soil and mineral analysis. Phase I. Chiu, N.W.; Dean, J.R.; Sill, C.W. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jul 1984. 46p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700459.

Several techniques of sample attack for the determination of radioisotopes are reviewed. These techniques include: 1) digestion with nitric or hydrochloric acid in Parr digestion bomb, 2) digestion with a mixture of nitric and hydrochloric acids, 3) digestion with a mixture of hydrofluoric, nitric and perchloric acids, and 4) fusion with sodium carbonate, potassium fluoride or alkali pyrosulfates. The effectiveness of these techniques to decompose various soils and minerals containing radioisotopes such as lead-210, uranium, thorium and radium-226 are discussed. The combined procedure of potassium fluoride fusion followed by alkali pyrosulfate fusion is recommended for radium-226, uranium and thorium analysis. This technique guarantees the complete dissolution of samples containing refractory materials such as silica, silicates, carbides, oxides and sulfates. For the lead-210 analysis, the procedure of digestion with a mixture of hydrofluoric, nitric and perchloric acids followed by fusion with alkali pyrosulfate is recommended. These two procedures are detailed. Schemes for the sequential separation of the radioisotopes from a dissolved sample solution are outlined. Procedures for radiochemical analysis are suggested.

11615 (INIS-BR—379) Study and application of ion chromatography and activation analysis without chemical separation for the determination of sodium and potassium in muscle tissues. Haber, E.P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1984. 89p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. File Number DE86780344.

The simultaneous determination of Na and K in small amounts of muscular tissue by use of two methods, namely activation analysis and ion chromatography, is presented. For the activation analysis the samples were irradiated for 30 minutes in a 5 x 10^{11}n cm^{-2} s^{-1} flux. The induced activities of ^{24}Na and ^{42}K were determined, without chemical separation, using a Ge(Li) detector equipped with a 4096 channel analyser on-line with a computer. The gamma ray spectra registered from the samples and standards were analysed and compared by the computer. For the ion chromatography analysis the samples and standards in solution were injected into the apparatus. The ions were separated by an ion-exchange system of columns and the concentrations were measured by conductivity. In addition, the two analytical methods were compared in regard to sensitivity, precision and accuracy as well as simplicity, cost and working time involved in the analysis. From the point of view of the reliability of the results, both techniques proved to be excellent and might be of great value in medical research.

11616 (LUNFD6/NFFR—1007/1-121(1985)) Activation measurements of neutron-capture cross sections in the MeV region. Andersson, P. (Lund Univ. (Sweden). Dept. of Physics). Apr 1985. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700432.

Activation measurements in the MeV region are frequently disturbed by accompanying low-energy background neutrons. These neutrons are produced by nonelastic neutron reactions (e.g. (n,n'), (n,np) and (n,2n) reactions) in the irradiated sample and surrounding materials as well as by charged-particle reactions in the target materials. Capture measurements are particularly sensitive, and the contribution to the activation yield may be significant already at 1-2 MeV. Experimental techniques for cross-section measurements were developed in which the background influence was minimized by the appropriate choice of target materials and experimental arrangements. The remaining contributions were determined by systematically varying the experimental conditions. The methods were applied to capture cross-section measurements for ^{115}In and ^{197}Au in the neutron energy region 2.0-7.7 MeV, and for ^{23}Na, ^{55}Mn, ^{89}Y, ^{127}I, ^{138}Ba, ^{186}W and ^{197}Au at 14.7 MeV. Cross sections for the reactions ^{27}Al(n,np)^{27}Mg, ^{27}Al(n,α)^{24}Na, ^{115}In(n,n')^{115}In and ^{197}Au(n,2n)^{196}Au were also measured at 14.9 MeV. Some of the results are compared with statistical model calculations.

11617 **(LYCEN—8346) Capabilities of light element surface analysis by nuclear microanalysis.** Ramdane, D. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire; Lyon-1 Univ., 69 - Villeurbanne (France)). 1984. 90p. (In French). NTIS (US Sales Only), PC A05/MF A01. File Number DE86750348.

This work is aimed showing up a surface study possibilities of nuclear microanalysis. Essential qualities of this technique (quantitivity, sensitiveness, non destructive profiles) are indeed far from to have been completely exploited in this field, particularly for light elements in high Z matrices. First, have been evolved UHV technologies essentially applied to hydrogen quantitative determination by the H (^{15}N, αsub(γ)) nuclear reaction. First results are presented for titanium hydridation mechanism study and hydrogen adsorption on polycrystalline nickel. It has been shown that, in the first case, there is bulk scattering strongly dependent on surface contamination. The second case allowed to measure coherent recovering rates even if cleaning techniques appear insufficient. Then a new analysis method has been evolved which is based on recoil nucleus detection after fast heavy ion elastic scattering (about 20 MeV for argon). The time-of-flight detector allowed to show that carbon and oxygen quantitive determination is possible in heavy matrices (Ti for instance) with depth resolution less than 10 nm and sensitivity of about 5 10^4 at/cm^2.

11618 **(NUCLEBRAS-CDTN—465) High precision spectrophotometric analysis of thorium.** Palmieri, H.E.L. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). 1984. 109p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86700460.

An accurate and precise determination of thorium is proposed. Precision of about 0,1% is required for the determination of macroquantities of thorium when processed. After an extensive literature search concerning this subject, spectrophotometric titration has been chosen, using dissodium ethylenediaminetetraacetate (EDTA) solution and alizarin-S as indicator. In order to obtain such a precision, an amount of 0,025 M EDTA solution precisely measured has been added and the titration was completed with less than 5 ml of 0,0025 M EDTA solution. It is usual to locate the endpoint graphically, by plotting added titrant versus absorbance. The non-linear minimum square fit is preformed using the Fletcher and Powell's minimization process and a computer programme. Besides the equivalence point, other parameters of titration were determined: the indicator concentration, the absorbance of the metal-indicator complex, and the stability constants of the metal-indicator and the metal-EDTA complexes.

11619 **(ORNL/TM—9779) Evaluation of uranium and plutonium internal standards.** Smith, D.H.; Walker, R.L.; Carter, J.A. (Oak Ridge National Lab., TN (USA)). Nov 1985. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004650.

Two internal standards have been synthesized and evaluated for application in mass spectrometric analysis of uranium. Each standard is a mixture of highly enriched ^{233}U and ^{236}U. One is used to refine ^{235}U/^{238}U ratio measurements and the other for isotope dilution applications. An internal standard consisting of a mixture of ^{242}Pu and ^{244}Pu has been characterized for use in plutonium analyses. Precisions obtainable on pulse-counting instruments have been improved to about 0.1%. 21 refs., 13 tabs.

11620 **(PNL-SA—13233) Supercritical fluid methods for the analysis of complex fuel and environmental samples.** Smith, R.D.; Yonker, C.R.; Kalinoski, H.T.; Chess, E.K.; Udseth, H.R.; Frye, S.L.; Wright, B.W. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1985. Contract AC06-76RL01830. 28p. (CONF-8510225—4). NTIS, PC A03/MF A01; GPO Dep. File Number DE86004868.

From Hanford life sciences symposium; Richland, WA, USA (21 Oct 1985).

The application of supercritical fluid methods can greatly improve the analysis of complex mixtures spanning wide chemical classes. In separations from complex matrices supercritical fluids can be used to improve both extraction efficiency and speed. The variable solvating powers and gas-like diffusion coefficients and viscosities can provide efficient new methods for sample enrichment, cleanup and fractionation. Supercritical fluid chromatography (SFC) is applicable to both thermally labile and less volatile materials. The use of small diameter (25- to 50-μm) fused silica capillary columns provides chromatographic efficiencies for SFC that are nearly comparable to conventional capillary gas chromatography and much greater than practical by liquid chromatography (LC). The development of practical capillary SFC-MS instrumentation, allowing both electron impact and chemical ionization mass spectrometry (MS), is expected to provide a powerful alternative to LC-MS for complex mixture analysis. Recent results will be presented on the development of methods for the analysis of fuels, labile pollutants, hazardous solic waste materials, and related complex environmental mixtures. The application of various supercritical fluids for sample extraction, SFC and SFC-MS, and the recent development of a system for automated supercritical fluid extraction-chromatography will also be described. Finally, the potential role of supercritical fluid methods in routine chemical analysis will be discussed. 16 refs., 11 figs.

11621 **(PNL-SA—13275) Technique for comparing AES signals from different spectrometers using common materials.** Baer, D.R.; Thomas, M.T. (Pacific Northwest Labs., Richland, WA (USA)). Oct 1985. Contract AC06-76RL01830. 17p. (CONF-851174—26). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004857.

From 32. national vacuum symposium and topical conference; Houston, TX, USA (19 Nov 1985).

A simple procedure is outlined to obtain relative sensitivity curves that allow data collected on one Auger electron spectrometer to be related to data collected on a different spectrometer or to a standard data set. Data collected on three CMA systems demonstrates that dN/dE peak to peak amplitude ratios for pure elements can vary considerably but in a systematic manner for different systems. Such differences can be produced by variations in system design, by specimen or electron gun alignment, spectrometer contamination or other problems. However if the differences in relative sensitivity are considered in the data analysis, data sets from different systems can be interrelated with reasonable accuracy.

11622 **(RHO-QA-SA—14) Comparison of different methods of determining plutonium content and isotopic composition.** Dowell, M.R.W. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). May 1985. Contract AC06-77RL01030. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86002896.

At Rockwell Hanford Operations, several different methods are used to determine plutonium content and isotopic composition. These include alpha particle energy analysis, calorimetry/gamma-ray analysis, mass spectrometry, and low energy ray assay. Each is used in a process control environment and has its advantages and disadvantages in terms of sample matrix, sample preparation, concentration, error ranges, detection limits, and turn around time. Of the methods discussed, special attention is paid to the Plutonium Isotopics Solution Counter, a low energy gamma ray assay system designed to provide plutonium and americium content and isotopic composition of Pu-238 through Pu-241 and Am-241. It is qualitatively and quantitatively compared to the other methods. A brief description of sample types which the Solution Counter analyzes is presented. 4 refs., 4 tabs.

11623 **(ZfK—524) Proceedings of the third meeting on nuclear analysis.** (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Chemische Gesellschaft der Deutschen Demokratischen Republik, Berlin). Apr 1984. 554p. (In English, German and Russian). (CONF-8304171—). NTIS (US Sales Only), PC A24/MF A01. File Number DE86700458.

From 3. meeting on nuclear analysis; Dresden, German D.R. (11 Apr 1983).

This international meeting presents a series of methodical and device developments in the field of nuclear analysis techniques such as nuclear reaction analysis, activation analysis, pixe analysis, tracer techniques or atom and nuclear spectroscopy. The applications cover an extensive field in energetics, geology, medicine, biology, environment protection, materials science etc. and are presented in 141 papers.

11624 Mass spectrometry of inductively coupled plasmas. Houk, R.S. (Iowa State Univ., Ames). *Analytical Chemistry;* **58**: No. 1, 97A-105A(Jan 1986). Contract W-7405-ENG-82.

The alliance of the ICP with MS shows promise of extending the sensitivity and selectivity of MS to elemental analysis of solutions. Some additional areas of research interest for ICP-MS include the following: its use as an element and isotope selective detector for chromatography, flow injection analysis, laser ablation, and other sample introduction techniques; fundamental studies of ionization other basic processes in the ICP; detection of halogens and perhaps other elements as negative ions; and auxiliary ionization of neutral analyte atoms formed from ICP ions that have recombined with electrons during the extraction process. The latter concept is particularly interesting because the present detection limits for ICP-MS are achieved even though only one analyte ion is detected for every 10^5 or 10^6 that would be going through the skimmer if no recombination occurred. 42 references, 6 figures, 2 tables.

11625 Suppression of analyte signal by various concomitant salts in inductively coupled plasma mass spectrometry. Olivares, J.A.; Houk, R.S. (Iowa State Univ., Ames). *Analytical Chemistry;* **58**: No. 1, 20-25(Jan 1986). Contract W-7405-ENG-82.

The interference on the ionization of cobalt by five salts, NaCl, $MgCl_2$, NH_4I, NH_4Br, and NH_4Cl, in an inductively coupled plasma (ICP) is first looked at theoretically, and subsequently the theoretical trends are established experimentally by mass spectrometry (ICP-MS). The interference trends are found to be in the order of the most easily ionized element in the matrix salt, i.e., Na > Mg > I > Br > Cl. Quantitatively the theoretical values for the amount of salt needed to produce a particular interference are 1-2 orders of magnitude higher than the experimentally determined values. The results reported here indicate that ICP-MS is somewhat more susceptible to ionization suppression effects than ICP atomic emission spectrometry. It is also found that the most easily ionized element in the salt dominates the matrix ion spectrum observed from the ICP in the order mentioned above. Total ion current measurements by ICP-MC at solute levels above 1% are complicated by orifice plugging and transport loss of the salt and analyte in the desolvation system for the ultrasonic nebulizer used. 27 references, 7 figures, 3 tables.

11626 Extraction of arsenic(III) and arsenic(V) from natural waters for neutron activation analysis. Mok, W.M.; Shah, N.K.; Wai, C.M. (Univ. of Idaho, Moscow). *Analytical Chemistry;* **58**: No. 1, 110-113(Jan 1986).

Quantification and speciation of arsenic(III) and arsenic(V) in natural waters can be achieved by extracting the former species with pyrrolidinecarbodithioate at pH 1-1.5 into chloroform followed by a nitric acid back extraction for neutron activation analysis (NAA). Besides eliminating interferences from matrix species in natural waters, the two-step extraction procedure also provides a large preconcentration factor for arsenic. Detection of 10^{-2} μg/L of arsenic can be achieved by using this extraction method and NAA. Applications of this method to arsenic speciation studies in natural water systems are discussed.

11627 Competitive solvent extraction of alkaline-earth cations into chloroform by lipophilic acyclic diionizable polyethers. Walkowiak, W.; Stewart, L.E.; Lee, H.K.; Czech, B.P.; Bartsch, R.A. (Texas Tech Univ., Lubbock). *Analytical Chemistry;* **58**: No. 1, 188-191(Jan 1986). Contract AS05-80ER10604.

Competitive solvent extraction of alkaline-earth cations from aqueous solutions into chloroform by two series of lipophilic acyclic polyether dicarboxylic acids and one series of lipophilic acyclic polyether phosphonic acid monoethyl esters is reported. The influence of the polyether chain length and type of ionizable group upon extraction selectivity and efficiency is assessed.

11628 Determination of nitrogen-sulfur compounds by ion chromatography. Littlejohn, D.; Chang, S.G. (Univ. of California, Berkeley). *Analytical Chemistry;* **58**: No. 1, 158-160(Jan 1986). Contract AC03-76SF00098.

Ion chromatography was used in the determination of hydroxyimidodisulfate, hydroxysulfamate, imidodisulfate, and N-nitrosohydroxylamine-N-sulfonate compounds. Bicarbonate (1.5 mM) was used as an eluent with a standard separation column for separation of the singly charged anions. Carbonate (12 or 18 mM) was used as an eluent with a short separation column for separation of the doubly charged anions. The detection limits for these compounds were as follows: hydroxyimidodisulfate, 7.4×10^{-6} M; hydroxysulfamate, 0.5×10^{-6} M; imidodisulfate, 1.4×10^{-6} M; and N-nitrosohydroxylamine-N-sulfonate, 14×10^{-6} M. Ion chromatography was found to have an advantage in speed and sensitivity compared to other determination methods. 11 references, 5 figures.

11629 Selection of adsorbates for chemical sensor arrays by pattern recognition. Carey, W.P.; Beebe, K.R.; Kowalski, B.R.; Illman, D.L.; Hirschfeld, T. (Univ. of Washington, Seattle). *Analytical Chemistry;* **58**: No. 1, 149-153(Jan 1986).

Pattern recognition techniques were applied to frequency shift data obtained from 27 piezoelectric sensors, formed by coating quartz crystals with 27 different GC stationary phases, tested using 14 analytes. The objective was to determine whether or not the 27 original coatings could be reduced to a subset of coatings without a significant loss of analyte identification information. The amount of information loss with a given decrease in dimensionality and the identity of the coatings in the best subset of coatings was sought. The first seven principal components described almost 95% of the variance in the original data set of 27 coatings. A generally useful procedure is proposed and tested herein that allowed the selection of seven coatings that provided the maximum level of analyte discriminating ability. This procedure allows other factors (cost, reliability, etc.) to enter into the selection process while maintaining maximum analytical power with the fewest sensors. 7 references, 2 tables.

11630 Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography. Wright, B.W.; Kalinoski, H.T.; Smith, R.D. (Battelle Northwest Labs., Richland, WA). *Analytical Chemistry;* **57**: No. 14, 2823-2829(Dec 1985).

The influence of various mobile phases on the retention and selectivity of a polarity-test mixture in capillary supercritical fluid chromatography (SFC) was investigated. Capacity ratios and selectivities were obtained under equivalent chromatographic operating conditions using supercritical carbon dioxide, nitrous oxide, and ethane mobile phases and a relatively nonspecific 5% phenyl poly(methylphenylsiloxane) stationary phase. A 2.5% (w/w) mixture of methanol in carbon dioxide was also evaluated. In addition, chromatographic efficiency was compared at similar k' for each fluid. Carbon dioxide and nitrous oxide exhibited similar solvating power with only slight differences in selectivity. Ethane, being less polar, displayed the poorest solvating power for the polar solutes and offered greater differences in selectivity. The greatest differences in selectivity were observed at lower temperatures and higher densities. The carbon dioxide-methanol fluid mixture displayed different selectivity than pure carbon dioxide, but not to the same extent as reported for packed column SFC. 27 references, 4 figures, 7 tables.

11631 Pressure programming in supercritical fluid chromatography. Smith, R.D.; Chapman, E.G.; Wright, B.W. (Pacific Northwest Lab., Richland, WA). *Analytical Chemistry;* **57**: No. 14, 2829-2836(Dec 1985). Contract AC06-76RL01830.

A theoretical and experimental study of pressure programming in capillary supercritical fluid chromatography (SFC) is reported. For the case of linear density programming, relationships are derived between retention time, programming rate, and peak width using the capacity ratio-density dependence obtained from isobaric studies. Linear velocity in SFC is shown to depend on both pressure and programming rate due to fluid compressibility. Numerical calculations are shown to accurately predict retention times under rapid pressure programming and account for changes in linear velocity. Similarly, peak width data can be approximated by numerical methods using the capacity ratio at elution and the often substantial contribution due to peak compression. These results are used to explore the relative quality of separations obtained under pressure programming, and it is shown that a significant im-

provement in separation quality per unit time is feasible at increased programming rates. Further practical implications of these results relevant to column evaluation, injector-splitter design, and determination of optimum separation parameters are discussed. 22 references, 10 figures, 3 tables.

11632 Standardization of alumina and silica adsorbents used for chemical class separations of polycyclic aromatic compounds. Later, D.W.; Wilson, B.W.; Lee, M.L. (Battelle, Pacific Northwest Lab., Richland, WA). *Analytical Chemistry;* **57**: No. 14, 2979-2984(Dec 1985). Contract AC06-76RL01830;AC02-79EV10237.

The reproducibility of separating polycyclic aromatic compounds (PAC) by adsorption chromatography is known to be a function of the adsorbent's activity, i.e., water content. In this work, a multiple-point R^0 calibration curve (equivalent retention volume vs. adsorbent activity) was constructed by using a model solute/solvent system (naphthalene/hexane) for two commonly used adsorbents. The optimum activities for neutral alumina and silicic acid, two adsorbents used in a previously reported separation method designed to provide chemical class separation of complex, coal-derived mixtures, were determined by using the R^0 calibration-curve method. The optimum activity ranges for these adsorbents, as used in this separation method, were 1.0-1.5% H_2O (w/w) for alumina and 5-8% H_2O (w/w) for silicic acid. Once the R^0 calibration curves were constructed for these two adsorbents, they were used to standardize and routinely monitor their activities. Finally, this standardization technique was used to determine the required oven temperature at which alumina (150°C) and silicic acid (50°C) could be stored so that they reached and maintained their determined activity levels. 18 references, 7 figures, 3 tables.

11633 Trace detection based on chemical amplification of the optoacoustic effect. Choi, J.G.; Diebold, G.J. (Brown Univ., Providence, RI). *Analytical Chemistry;* **57**: No. 14, 2889-2991(Dec 1985).

In contrast to excitation in the infrared, generation of the optoacoustic effect in the visible or ultraviolet region of the spectrum opens up the possibility of initiation of chemical reactions such that the energy released by the reactions far exceeds the amount of energy absorbed from the light beam. Since the magnitude of the optoacoustic effect is proportional to the amount of heat liberated by the chain reaction, the effect of the addition of a radical scavenger is to quench the chemical liberation of heat in the spectrophone and hence to decrease the acoustic signal amplitude. A new highly sensitive method of trace detection using both chemical amplification and quenching of the optoacoustic effect is reported. 22 references, 3 figures, 1 table.

11634 Effect of very weak laser sidebands on optical spectra involving easily saturable intermediate states. Nogar, N.S.; Keller, R.A. (Los Alamos National Lab., NM). *Analytical Chemistry;* **57**: No. 14, 2992-2993(Dec 1985).

In this report the intense structure on the resonance ionization mass spectrum of lutetium atoms is described. It is demonstrated that this structure is caused by weak sidebands on the dye laser output. 8 references, 2 figures.

11635 Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures. Kaczvinsky, J.R. Jr. Ames, IA; Iowa State Univ. (1984). 250p. University Microfilms Order No. 85-05,832.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Trace level organic bases are concentrated from aqueous solution by cation exchange on a column of sulfonated macroreticular XAD-4 resin. Washing of the column with organic solvents removes neutrals and acids. Ammonia gas is introduced into the column prior to elution of the basic organics with either methanol or ether containing ammonia. After solvent evaporation, the concentrated sample is analyzed by gas chromatography. Recoveries of over 85% are found with at least one of the eluents for over 50 bases tested at levels < 1 ppm. Improved recoveries and reproducibility are seen over a simple ether extraction procedure. Samples of river water, shale oil process water, and supernatant from an agricultural chemical disposal pit are analyzed. Preliminary studies of functionalized poly(styrene-divinylbenzene)s, coated exchangers, and liquid ion exchangers as possible approaches to nuclear waste decontamination are performed.

11636 New laser spectroscopic technique for stable-isotope ratio analysis. Tong, W.G. Ames, IA; Iowa State Univ. (1984). 251p. University Microfilms Order No. 85-05,876.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Reliable and safe application of isotopes as tracers is important in many areas, including biomedical, environmental and geochronological sciences. A new approach to stable-isotope ratio analysis based on atomic hyperfine structure is demonstrated. This laser spectroscopic scheme is virtually interference-free because of the highly selective and specific nature of hyperfine structures. Hence, a minor constituent in a complex matrix can be selectively analyzed without extensive sample preparation. A single-frequency tunable cw ring dye laser is used as the excitation source and a specially designed and constructed demountable cathode discharge is used as the atomizer and detector. Samples are electrodeposited on the demountable cathode and hyperfine profiles are collected by optogalvanic detection. By spectral deconvolution, the relative abundances of all isotopes present can be determined with good accuracy and precision. The technique is demonstrated for copper concentrations as low as 1.6 ppm, using the atomic hyperfine structure of CuI 578.2 nm non-resonance transition. It is also successfully tested for analysis of copper isotopes in human blood.

11637 Trace detection in gases using photoacoustic spectroscopy and Fabry-Perot interferometry. Yip, B.C.Y. Ames, IA; Iowa State Univ. (1984). 207p. University Microfilms Order No. 85-05,888.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Two thermooptic-based detection systems for gases were developed and studied for their performances in monitoring air pollutants. In the first system which is based on the photoacoustic effect, a continuous-wave carbon dioxide laser was adapted for operation in the infrared with its output wavelength modulated between two consecutive vibration-rotation lines. This was accomplished by applying a time-varying electric field to a commercial piezoelectric pusher attached to the grating mount of the laser. Operating under wavelength modulation, the primary limitation on detectability in photoacoustic measurements - window absorption - was removed and the useful range for application was extended. This concept was illustrated by the determination of ppb levels of ethylene in nitrogen. The feasibility of using Fabry-Perot interferometry for in situ trace detection of gases was studied. The Fabry-Perot interferometric experiment was based on a single-beam geometry using modulated excitation and coherent detection of the signal. A laboratory built position stabilization circuit was employed to maintain the interferometer at its optimum point of operation. By combining this with wavelength modulation, the projected detection limit of the resulting scheme for C_2H_4 in nitrogen was found to be 20 ppb (S/N = 3).

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 11176, 11580, 11601, 11696, 11725, 12062, 12385

11638 (AD-A—157940/8/XAB) Relationships between electronic spectroscopy and electrochemistry. A probe of reorganisation energies. Technical report. Dodsworth, E.S.; Lever, A.B.P. (York Univ., Downsview, Ontario (Canada). Dept. of Chemistry). May 1985. 18p. (TR—2). NTIS, PC A02/MF A01.

The electronic spectra and electrochemical potentials of the species Ru(bipy)x(NN)3-x(2+)(bipy = 2,2'-bipyridine, NN = unsaturated diimine, x = 1,2) are correlated via fundamental relationships involving reorganisation and solvation energies. It is argued that the presence of two distinct Ru → ligand charge-transfer transitions allows comparison of the reorganisation energies therefore.

11639 (AD-A—158282/4/XAB) Application of quantum chemistry to atmospheric chemistry. Final report, 1 October 1983-30 September 1984. Krauss, M.; Stevens, W.J. (National Bureau of Standards, Washington, DC (USA). Quantum Chemistry Group). 30 Sep 1984. 118p. NTIS, PC A06/MF A01.

Analysis of the accuracy of the experimentally deduced dissociation energies of refractory metal salts requires a knowledge of the electronic structure of the molecules. Relativistic effective potentials (REP) have now made such calculations for metal-containing molecules possible. This report describes tests and applications of the effective potential method. A review was completed of the use of effective potentials in molecular quantum chemistry. The review is given in Section 2. In Section 3 the abstract is given for the paper on Relativistic Effective Potential SCF Calculations of AgH and AuH, which has been accepted by the Journal of Computational Chemistry. The preprint for the analysis of the Electronic Structure of FeO and RuO is given in Section 4. Analysis of the orbital structure establishes the basis for an aufbau for the ground state of all the transition metal oxides in the first two rows. Preliminary results were reported for NdO^+, NdO, and UO in last years report but a new set of CEP are now being developed for the lanthanides and actinides. This is a preliminary to a study of other lanthanide oxides and to polyatomic systems using the CEP. The abstract for the paper Compact Effective Potentials and Efficient Shared-Exponent Basis Sets for the First- and Second-Row Atoms is given in Section 5. Application to the analysis of the spectra of Al2 is described in the abstract for the paper Electronic State of Al2.

11640 (AD-A—158402/8/XAB) Nuclear-motion corrections to Born-Oppenheimer barrier heights for chemical reactions. Garrett, B.C.; Truhlar, D.G. (Chemical Dynamics Corp., Columbus, OH (USA)). 15 May 1985. 7p. NTIS, PC A02/MF A01.

The electronic adiabatic approximation without nuclear-motion corrections, also known as the Born-Oppenheimer approximation, has been successfully and widely used in chemistry. This approximation may fail seriously when two adiabatic potential energy curves exhibit a narrowly avoided crossing. An interesting intermediate case for the electronic adiabatic approximation is the case of a widely avoided intersection because most potential energy barriers to chemical reactions may be considered to arise form widely avoided intersections. Estimates of the nuclear-motion corrections to the barriers are presented for several atom-diatomic reactions using the diatomics-in-molecules (DIM) theory. The reactions of H, O, F, and Cl with H_2 and H with Cl_2 are examined. Nuclear-motion corrections at the saddlepoint are in the range 0.007-0.07 kcal/mol for cases with one or two hydrogens and classical barrier heights in the range 0.7-3 kcal/mol and are about 0.2 kcal/mol for cases with one or two hydrogens and classical barrier heights in the range 8-12 kcal/mol. For F + H2 with parameters such that the predicted nuclear-motion correction is 0.03 at the saddle, the correction is as large as 0.2 kcal/mol elsewhere on the surface.

11641 (CBPF-NF—008/84) Some considerations about bond indices in non-orthogonal bases and the MO calculation of valence and oxidation number. Giambiagi, M.S. de; Giambiagi, M.; Jorge, F.E. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 52p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86700462.

In order to guarantee the desired invariance properties of bond indices, the importance of expliciting the tensor character of the matrices concerned, so as to deal with a contraction in the tensor sense between a covariant index and a contravariant one is shown. An MO valence definition using Wiberg's indices is generalized to non-orthogonal bases and a straight forward definition of oxidation numbers is proposed. IEH calculations of their magnitudes for some appropriate examples are performed: they emphasize the role of 'secondary' bonds in N and C-containing compounds; the hydrogen behaviour in half-bonds and strong H-bonds is satisfactorily accounted for; valence and oxidation number values are assigned to Fe, Co and Ni in a few complexes.

11642 (DOE/ER/04991—5) ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report. Freed, J.H. (Cornell Univ., Ithaca, NY (USA). Dept. of Chemistry). Nov 1984. Contract AC02-78ER04991. 80p. (COO—4991-5). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86004294.

This project was directed to developing ESR for the study of surface adsorption and catalysis on clean and well-characterized metallic and oxide surfaces under uhv conditions to compare the results of such studies with "real" surfaces, which are important in actual catalysis. Time resolution of the order of nanoseconds was to be introduced in the study of catalytic processes by means of Laser Time Resolved Electron-Spin Echo (ESE) Spectroscopy. We conducted an extensive study of the new phenomenon of surface-suppressed ESR (SSESR); in which stable paramagnetic radicals adsorbed on clean Ag or Cu surfaces have their ESR signal suppressed until several layers of molecules effectively insulate subsequent layers from the metal surface. This study employed a combination of uhv-ESR, CREMSEE, and thermal desorption techniques. A tentative model based upon transmission of the effects of the surface conduction band of the metal by the weak exchange forces between the paramagnetic species was suggested. In other work: an extended Hueckel MO analysis of our previous O_2/Tivycor study was completed; a new and improved photo-CREMSEE apparatus was completed and utilized; analysis of our motional dynamics study of NO_2 on zeolites was carried out; and preliminary efforts directed to developing a photo-induced source of H atoms for Laser Time Resolved ESE experiments were carried out. 54 refs., 30 figs., 6 tabs.

11643 (DOE/ER/13152—1) Interferometric measurement techniques in double-diffusive systems. Technical progress report. (Illinois Inst. of Tech., Chicago (USA). Dept. of Civil Engineering). [1986]. Contract AC02-84ER13152. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005507.

In order to determine the refractive index of saline-water solutions as a function of temperature and concentration for two source wavelengths, a quartz test tank was built and installed into the dual-frequency test system. A schematic of the test tank and the associated water-saline solution flow system is shown. By using the Mach-Zehnder interferometer, small changes in the index of refraction, within $+\text{-}10^{-7}$, can be accurately determined. This experimental method was selected over the method of "minimum angle of deviation" since the latter technique would be more laborious for measurement of both saline and temperature effects on the refractive index. Also, the capital equipment required to attain similar precision ($+\text{-}10^{-7}$) is prohibitively expensive. 1 ref., 5 figs.

11644 (IAEA-TC—427/6) Hydrogen behaviour and control and related containment loading aspects. Proceedings of a specialists' meeting organized by the IAEA and held in Suzdal, USSR, 19-23 September 1983. (International Atomic Energy Agency, Vienna (Austria). Technical Committee on Thermal Reactor Safety Research). Sep 1984. 102p. (CONF-8309265—; TC-SR—2). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780327.

From IAEA specialists meeting on hydrogen behaviour and control and related containment loading aspects; Suzdal, USSR (19 Sep 1983).

Translated from Russian.

Separate abstracts were prepared for 6 reports in scope of the data base. (PLG)

11645 (IAEA-TECDOC—337, pp 173-194) Synthetic inorganic ion exchangers and their potential use in the nuclear fuel cycle. Clearfield, A. (Texas A and M Univ., College Station (USA)). Jul 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463. (CONF-8406123—).

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

This paper describes the structure and principal ion exchange characteristics of acid salts of polyvalent metals and hydrous oxides. The acid salts can be prepared in crystalline (layered) form, as amorphous gels and in intermediate stages of crystallinity.

Ion exchange behavior is then related to the crystallinity of the exchanger. Separations of importance to nuclear technology are also described. The acid salts can be classified into five types based upon structure. The hydrous oxides are considered to fall into two main types. Those such as ZrO_2, TiO_2 and SnO_2 consist of small particles of oxide with hydrated surfaces and interparticle water. The nature of the surface is described and related to the ion exchange properties of the hydrous oxide. Other hydrous oxides such as Sb_2O_5 and MnO_2 are described in terms of the pyrochlore and spinel structures, respectively. It is suggested that the properties of these exchangers can be controlled to greater specificities through synthetic procedures.

11646 (IAEA-TECDOC—337, pp 195-211) **Fundamental properties of acid salts of tetravalent metals and some considerations on the perspectives of their application in nuclear technology.** Alberti, G. (Department of Chemistry, Perugia Univ. (Italy)). Jul 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463. (CONF-8406123—).

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

Beginning from 1964, acid salts of tetravalent metals started to be obtained as crystalline materials and research was essentially focused for many years in their syntheses and structures. Now that the chemistry of these inorganic ion-exchangers is well enough established, interest has turned to their uses in various technological fields. Among them, their employment in the nuclear fuel cycle as well as in the recovery, separation and purification of some radionuclides is very attractive. After a brief survey in the syntheses and classification of the various acid salts and their derivatives and after a short review of the ion-exchange properties of zirconium phosphate and its salt forms with α and γ lamellar structures some properties such as hydrolysis and stability towards temperature and ionizing radiations, that are of fundamental importance for their use in nuclear technology, are reported and discussed.

11647 (IAEA-TECDOC—337, pp 249-262) **Studies on inorganic ion exchangers. Fundamental properties and application in nuclear energy programmes.** Iyer, R.M.; Gupta, A.R.; Venkataramani, B. (Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.). Jul 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463. (CONF-8406123—).

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

Investigations on inorganic ion exchangers have been carried out with a view to understand the fundamental properties and to assess their suitability in specific applications in the Nuclear Fuel Cycle. Method of preparation had a marked influence on the structure and properties of this class of materials, as in the case of crystalline thorium arsenate (TA) and hydrous oxides, especially hydrous titanium oxide (HTiO). The new crystalline modifications of TA, in contrast to the monohydrate, exchanged larger ions like Na^+, K^+ in addition to Li^+, due to the large interlayer spacings. Hysteresis in H^+-Li^+ exchange was observed. The selectivity sequences for alkali, alkaline earth and transition metal ions on hydrous thorium oxide (HThO) and magnetite (MAG) were similar to those observed for other hydrous oxides. While hysteresis in anion exchange involving uni-univalent anions on HThO was observed, cation exchange reactions involving Ca^{2+} and Cu^{2+} were found to be non-reversible. Preliminary investigations on the usefulness of hydrous oxides in the recovery of uranium from sea water, and purification of reactor coolant water are reported in this paper. Different hydrous oxides having varying acidities were screened for their uranium sorption capacities. On HTiO, the most promising adsorbent among the hydrous oxides, the influence of anions on the sorption of uranium, the possible mechanism of sorption of uranium from carborate solutions and under simulated sea water conditions were studied. Investigations on the sorption of cationic corrosion products on hydrous zirconium oxide (HZrO), HThO and MAG up to 363 K and of anions on mixed oxides, like Bi(III)-Th(IV) mixed oxides, from alkaline solutions were carried out with a view to test their utility in reactor coolant water purification systems.

11648 (IAEA-TECDOC—337, pp 263-275) **Ion-exchange selectivities on antimonic acids and metal antimonates.** Abe, M. (Department of Chemistry, Tokyo Inst. of Tech., Ookayama (Japan)). Jul 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463. (CONF-8406123—).

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

Antimonic acids and metal antimonates as inorganic ion-exchangers exhibit extremely high selectivity for a certain element or group of elements for comparison with sulfonated polystyrene ion-exchange resin. Various antimonic acid materials have been obtained with different compositions and ion-exchange properties, depending on the method of their preparations as well as on aging. The species can be divided into three groups - crystalline, amorphous and glassy. The affinity sequence for alkali metal ions shows Li<Na<K<Rb<Cs on the amorphous and glassy acid, while Li<K<Cs<Rb<Na on the crystalline acid. However, slightly different affinity series have been reported by other authors, Cs<Li<Rb<K<Na or Rb=Cs<Na on the crystalline acid. Similar disagreement between various authors exists for alkaline earth metal cation series: Mg<Ca<Sr<Ba, Ra-Ba<Ca<Sr, Mg<Ba<Ca<Sr. These selectivities for various metal ions on the crystalline antimonic acid are discussed in the terms of rate of adsorption, steric effect, and host-guest co-relations. The antimonates of quadrivalent metal, such as Ti, Zr, and Sn, act as cation exchangers. The selectivity sequences for alkali metal ions show Li<Na<K<Rb<Cs on zirconium antimonate, Na<K<Rb<Li<Cs on titanium antimonate and Na<K<Rb<Cs<Li on tin antimonate with microamount of metal ions in acid media. However, titanium and tin antimonates exhibit a regular selectivity sequence for alkaline earth metal cations; Mg<Ca<Sr<Ba. The selectivity on the tin antimonate varies with the loading of the alkali metal ions on the exchanger for steric effect. The selectivity sequence for macro amounts shows Li>Na>K>Rb>Cs. These selectivities are discussed in the terms of steric effect and entropy changes of the ion-exchange reactions.

11649 (INFO—0133) **Experimental investigation of the rate of hydrogen absorption in zirconium-2.5 wt percent niobium from steam/hydrogen mixtures at elevated temperatures. Test specifications.** Langman, V.J. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Aug 1984. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700464.

The test specifications for an experimental program to study the rate of hydrogen absorption in zirconium-2.5 weight percent niobium pressure tube material from steam/hydrogen mixtures at elevated temperatures are discussed.

11650 **Surface-suppressed electron resonance spectroscopies.** Barkley, P.G.; Hornak, J.P.; Freed, J.H. (Baker Laboratory of Chemistry, Cornell University, Ithaca, New York 14853). *Journal of Chemical Physics;* **84**: No. 3, 1886-1900(1 Feb 1986). Contract AC02-78ER04991.

Surface-suppressed electron resonance spectroscopies (SSERS) refers to the phenomenon in which stable paramagnetic radicals adsorbed on clean (noble) metal surfaces have their ESR signal suppressed. This phenomenon is studied in some detail by ultra-high-vacuum ESR (UHV-ESR) and cyclotron resonance from microwave-induced secondary electron emissions (CREMSEE) in combination with conventional thermal desorption. The UHV-ESR is performed in situ on the inner surface of the microwave cavity after leaking in stable nitroxides as previously described by Nilges and Freed. In the SSERS phenomenon, the first layers of nitroxide deposited on the metal surface do not give rise to an observable ESR signal, even though a significant decrease in the CREMSEE microwave power threshold, P/sub t/, is observed. It is consistently found (for several nitroxides and noble metals) that an ESR signal is observed only when P/sub t/ has dropped to of the order of 20 (+-10)% of its initial value. The ESR signal then increases monotonically with increased dosage. Also, a correlation between these measured reductions in P/sub t/, and the estimated surface coverages required for initial observation of the ESR signal, is suggested by our results.

11651 X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-0.5x/ system. Fahey, J.A.; Weber, W.J.; Rotella, F.J. (Bronx Community College, NY). *Journal of Solid State Chemistry;* **60**: No. 2, 145-158(15 Nov 1985). Contract AC06-76RL01830.

The variation in lattice parameters with bulk composition and preparation temperature has been determined from X-ray powder diffraction data for the system Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-0.5x/. The structures of two members of this system have been further refined from time-of-flight neutron powder diffraction data using the Rietveld method. Both structures belong to the P6$_3$/m space group and are isomorphous with natural apatite, Ca$_{10}$(PO$_4$)$_6$(F,OH)$_2$. Samples prepared at 1250°C exhibit an ordered distribution of Ca and Nd cations between two nonequivalent sites. The room temperature lattice parameters of Ca$_2$Nd$_8$(SiO$_4$)$_6$O$_2$ are a = 9.5291(5) A and c = 7.0222(1) A, while those of Ca/sub 2.2/Nd/sub 7.8(SiO$_4$)$_6$O/sub 1.9/ are a = 9.5303(4) A and c = 7.0147(1) A. The composition of the latter member is believed to represent the upper limit of solid solution for this system at 1250°C.

11652 New high-pressure phase of solid CO$_2$. Hanson, R.C. (Arizona State Univ., Tempe). *Journal of Physical Chemistry;* **89**: No. 21, 4499-4501(10 Oct 1985).

Experimental evidence based on Raman scattering data in a diamond anvil cell is presented for a new phase III of solid CO$_2$ which occurs above 18 GPa at ambient temperature. This phase has a quite different low-frequency Raman mode pattern from the well-known Pa3 phase I. 13 references, 2 figures.

11653 Theoretical study of the heats of formation of SiH/sub n/, SiCl/sub n/, and SiH/sub n/Cl/sub n/ compounds. Ho, P.; Coltrin, M.E.; Binkley, J.S.; Melius, C.F. (Sandia National Lab., Albuquerque, NM). *Journal of Physical Chemistry;* **89**: No. 21, 4647-4654(10 Oct 1985). Contract AC04-76DP00789.

Energies from ab initio electronic structure calculations, combined with empirically derived bond correction factors for Si-H and Si-Cl bonds, have been used to derive a consistent set of heats of formation for the complete set of SiH/sub n/, SiCl/sub n/ ($n \leq 4$), and SiH/sub n/Cl/sub m/ ($n + m \leq 4$) species. The derived values are generally in agreement with literature values. However, some changes in currently accepted heats of formation are recommended. 93 references, 4 figures, 5 tables.

11654 Metal-support effects on H$_2$ and CO heats of adsorption on TiO$_2$-supported platinum. Vannice, M.A.; Hasselbring, L.C.; Sen, B. (Pennsylvania State Univ., University Park). *Journal of Physical Chemistry;* **89**: No. 14, 2972-2973(4 Jul 1985). Contract AC02-77ER04463.

Isothermal, integral heats of adsorption of H$_2$ and CO on supported Pt have been measured with a differential scanning calorimeter. For Pt dispersed on SiO$_2$, eta-Al$_2$O$_3$, and SiO$_2$-Al$_2$O$_3$, ΔH/sub (ad)/ values were 30 +/- 4 kcal/mol for H$_2$ and 28 +/- 4 kcal/mol for CO. For Pt/TiO$_2$ reduced at 473 K, similar, but slightly lower, values were obtained. However, after reduction at 773 K the markedly decreased chemisorption uptakes on TiO$_2$-supported Pt also showed significantly lower heats of adsorption for both H$_2$ and CO. These results provide direct evidence that adsorption capacity for CO and H$_2$ can be decreased by a change in the chemical nature of surface Pt atoms as well as by physical blocking of the Pt surface by migrating TiO/sub x/ species. 27 references, 1 table.

11655 Infrared spectra and structure of thin films of solid oxygen. Jones, L.H.; Swanson, B.I.; Agnew, S.F.; Ekberg, S.A. (Los Alamos National Lab., NM). *Journal of Physical Chemistry;* **89**: No. 14, 2982-2983(4 Jul 1985).

Using high-resolution spectroscopy, the authors have observed a metastable phase of oxygen formed in thin films from vapor deposition at 10 K. On heating above 12 K this phase converts irreversibly to the stable low-temperature α-phase. Isotopic studies and addition of small amounts of CO indicate that the unit cell must be large (at least 8 molecules per unit cell) and of low symmetry (with 4 crystallographically distinct O$_2$ molecules). 11 references, 1 figure.

11656 Inelastic neutron scattering spectrum of chromous acid at high energy transfers. Tomkinson, J.; Taylor, A.D.; Howard, J.; Eckert, J.; Goldstone, J.A. (Rutherford Appleton Lab., Chilton, England). *Journal of Chemical Physics;* **82**: No. 3, 1112-1114(1 Feb 1985).

The inelastic incoherent neutron scattering (INS) spectrum of chromous acid, at 77 K, is presented. It is dominated by the intense bending mode at 1254 cm^{-1} with some modes at lower frequencies showing indications of dispersion. The antisymmetric stretch nu/sub as/(OHS) (absolute value 1>-2>) was assigned to a broad band centered at ~ 2050 cm^{-1}, significantly displaced for the IR assignment (1650 cm^{-1}). The breadth of the band is due to the dispersion, and kinematic coupling, that is anticipated for this compound. These new data allow chromous acid to be fit more clearly into the general trend of hydrogen bonded compounds. Chromous acid compares very well in its overall INS spectrum with the isomorphous sodium bifluoride, except that the kinematic coupling between nu/sub as/(OHO) and the symmetric stretch does not occur in this compound.

11657 New metal-sulfur complexes from SO$_2$ reduction by (eta^5-C$_5$R$_5$)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO$_2$-sulfide bonding. Kubas, G.J.; Wasserman, H.J.; Ryan, R.R. (Los Alamos National Lab., NM). *Organometallics;* **3**: No. 2, 419-421(1985).

The title complexes are produced by direct reaction of CpW(CO)$_3$H or Cp/sup */W(CO)$_3$ with SO$_2$ (Cp/sup */ = C$_5$Me$_5$). X-ray structures reveal that [CpW(CO)$_3$]$_2$S possesses a bent, unsupported sulfide bridge, while [Cp/sup */W(CO)$_2$(μ-S. SO$_2$)]$_2$ contains the first structurally characterized example of a metal sulfide-SO$_2$ Lewis acid-base interaction.

11658 Synthesis of submicron titanium diboride powders. Brynestad, J.; Bamberger, C.E.; Heatherly, D.E.; Land, J.F. (Oak Ridge National Lab., TN). *High Temperature Science;* **19**: 41-49(1985). Contract W-7405-ENG-26.

New methods for the synthesis of submicron TiB$_2$ powders have been found and experimentally demonstrated. Three reactions schemes are proposed that all can give submicron TiB$_2$ powders as end product. The reactions take place as either 900 or 1500 K. Some properties of these powders are discussed.

11659 Transition metal-isocyanide bonding: Photoelectron spectroscopic study of iron tetracarbonyl isocyanide complexes. Beach, D.B.; Bertoncello, R.; Granozzi, G.; Jolly, W.L. (Univ. of California, Berkeley). *Organometallics;* **4**: No. 2, 311-316(1985). Contract AC03-76SF00098.

The He I and X-ray photoelectron spectra of the iron tetracarbonyl complexes of methyl, tert-butyl, trimethylsilyl, and phenyl isocyanide have been obtained. The bonding properties of these isocyanides are compared with those of carbon monoxide by using the core-binding energy data to interpret the valence ionization energies. The data show that all the isocyanides have comparable σ-donor ability and that, in the Fe(CO)$_4$CNR complexes, they are significantly weaker σ donors than carbon monoxide. The stronger σ-donor character of the coordinated CO ligands is presumably due to the σ-π synergism of the Fe-CO bonding. The net interaction of an isocyanide ligand with the iron d orbitals leaves the energy of the d orbitals destabilized relative to Fe(CO)$_5$. The data indicate that the relative energies of interaction of the d orbitals with the filled ligand π orbitals and the empty ligand π orbitals are different in Fe-CO and Fe-CNR bonds, with the interactions of the filled ligand π orbitals being relatively more important in Fe-CNR bonds than in Fe-CO bonds. The net electron withdrawal by a coordinated isocyanide ligand, although significant, is much lower than that by a coordinated carbonyl ligand. It is clear that the interactions of transition metals with isocyanides (and probably also with other ligands with similar electronic structures) cannot be adequately described without considering the combined σ-donor, π-acceptor, and π-donor characters of the ligands.

11660 Enthalpies of dilution of aqueous calcium chloride to low molalities at high temperatures. Simonson, J.M.; Busey, R.H.; Mesmer, R.E. (Oak Ridge National Lab., TN). *Journal of Physical Chemistry;* **89**: No. 4, 557-560(1985). Contract AC05-84OR21400.

The enthalpy of dilution of $CaCl_2$(aq) is obtained to a minimum molality of 1.7 x 10^{-3} mol x kg^{-1} at temperatures to 673 K from heat and liquid flow microcalorimetry. The measured dilution enthalpies at low concentrations above 573 K are more exothermic than those calculated from the limiting law. Comparison with similar results for NaCl(aq) indicates that extrapolation to infinite dilution based on strong electrolyte models for thermodynamic quantities may lead to significant error at high temperatures.

11661 Matter under extreme conditions of temperature and pressure. Ross, M. (Lawrence Livermore National Lab., CA). *Reports on Progress in Physics;* **48**: 1-52(1985). Contract W-7405-ENG-48.

Research on matter at extreme conditions has provided new insights into material behavior at atmospheric pressure. The application of high pressure is the simplest way to change the lattice spacing and has led to the discovery of new phenomena, new phases and new forms of electronic and ionic order. The application of high temperatures leads to melting, atomic and electronic excitation, and eventually to ionization and the formation of a plasma state. The combination of high pressures and temperatures continues to present a severe challenge to experimental and theoretical advances. However, current experimental methods permit material studies at pressures of several megabars and temperatures of tens of thousands of degrees Kelvin. The rapid surge in computer technology has, in turn, permitted the solution of many previously intractable theoretical problems. High-pressure research supplies information about the properties of geologic materials which, when coupled with data from seismic waves and space probes, provides information about the structure of planetary interiors.

11662 Time-resolved Auger electron spectroscopy combined with modulated molecular beam techniques for gas-surface reaction kinetics studies. Balooch, M.; Olander, D.R.; Abrefah, J.; Siekhaus, W.J. (Univ. of California, Berkeley). *Surface Science;* **149**: 285-292(1985). Contract AC03-76SF00098.

An Auger electron spectrometer is combined with a modulated beam system and the time-dependent concentration of adsorbed oxygen on a molybdenum surface subject to a chopped O_2 beam is measured and compared to predictions of a reaction kinetic model derived from modulated molecular beam spectroscopy alone.

11663 Preparation of $Yb[N(SiMe_3)_2]_2[AlMe_3]_2$. Complex with four Yb-Me-Al interactions. Boncella, J.M.; Andersen, R.A. (Univ. of California, Berkeley). *Organometallics;* **4**: No. 1, 205-206(1985). Contract AC03-76SF00098.

Trimethylaluminum reacts with base-free ytterbium bis[bis(trimethylsilyl)amide] to give $Yb[N-(SiMe_3)_2]_2[AlMe_3]_2$. The x-ray crystal structure provides evidence for four Yb-Me-Al and two Yb-Me-Si bridging interactions.

11664 Exponential separation and long-time correlation in collinear OCS. Davis, M.J. (Argonne National Lab., IL). *Chemical Physics Letters;* **110**: No. 5, 491-495(12 Oct 1984). Contract W-31-109-ENG-38.

It has been demonstrated that long-time correlations exist in the intramolecular dynamics of collinear OCS and can be investigated via exponential separation of trajectories. In particular, it has been shown how the rate of exponential separation slows down considerably when motion is trapped near islands of quasiperiodic behavior.

11665 Analytical solution for a first-order reaction in a packed bed with diffusion. Huang, J.C.; Rothstein, D.; Madey, R. (Kent State Univ., OH). *AIChE (American Institute of Chemical Engineers) Journal;* **30**: No. 4, 660-662(Jul 1984). Contract FG02-84ER13260.

The second Bromwich path of integration was chosen for the work described herein in order to derive the transient solution for a gas sample flowing through a packed bed where a first-order reaction takes place in the solid phase. The solution for a radioactive gas can be generalized from the solution presented here, and the solution for a nonradioactive gas is a simplification of the solution described here.

11666 Effect of potassium on the chemisorption of carbon monoxide on the Rh(111)crystal face. Crowell, J.E.; Somorjai, G.A. (Lawrence Berkeley Lab., CA). *Applications of Surface Science;* **19**: 73-91(1984). Contract AC03-76SF00098.

The adsorption of CO on the clean and potassium-predosed RH(111) crystal surface has been studied using temperature programmed desorption and high resolution electron energy loss spectroscopy. When 10% of a monolayer of potassium is preadsorbed, the thermal desorption spectrum of CO broadens up to 100 K higher temperature. In the presence of 10-36% of a monolayer of coadsorbed potassium, two new high temperature desorption maxima develop due to dissociation of CO. The CO stretching vibrations decrease continuously with either increasing potassium coverage or decreasing CO coverage. Substantial population and adsorption sequence shifts in site occupancy from the atop to the bridge site occur as a function of increasing potassium coverage. The results indicate both strengthening of the M-C bond and weakening of the C-O bond in the presence of potassium, due presumably to increased electron occupancy of the π^*-orbital of CO. Broadening and asymmetry of the vibrational peaks suggest the proximity of the CO molecules to the potassium adatoms influence the chemisorption behavior, although nonlocal interactions are also indicated.

11667 Silicon (111) and (100) surfaces and their interactions with Sc, K, Na and Li; phase changes and kinetics of desorption studied by surface ionization. Greene, E.F.; Keeley, J.T.; Pickering, M.A.; Stewart, D.K. (Brown Univ., Providence, RI). *Surface Science;* **139**: 185-207(1984).

The rates of desorption of Cs, K, Na, and Li atoms from the (100) and (111) surfaces of silicon are followed by surface ionization. In the temperature range of the experiments, 800-1000 K, the surfaces are prepared in two forms. The first are metastable ones produced by cooling the crystals rapidly to temperatures below their surface phase transitions. These are a well-known one for the (111) face at 1120-40 K and one for the (100) face at 980 +/- 20 K. The second forms are relatively stable surfaces to which the metastable ones convert spontaneously. On the metastable surfaces the desorption is first order and relatively rapid. Comparison with a model suggests that the atoms are highly mobile. On the more stable surfaces, where the desorption is mixed first and second order, a model fitting the results has the atoms also highly mobile but concentrated at steps or edges between terraces from which most of the desorption occurs. The sticking probability for the atoms is near unity on all the surfaces, and the smaller atoms, Na and Li, penetrate into the bulk to an appreciable extent.

11668 Polypyridyl hydrido complexes of osmium(II) and ruthenium(II). Caspar, J.V.; Sullivan, B.P.; Meyer, T.J. (Univ. of North Carolina, Chapel Hill). *Organometallics;* **1**: No. 4, 551-554(1983).

A series of polypyridyl hydrido complexes of Os(II) and Ru(II) has been prepared, e.g., cis-$[M(bpy)_2(CO)H]^{2+}$ (bpy is 2,2'-bipyridine; M = Ru, Os) and $[Os(phen)(1,2\text{-}(Ph_2P)_2C_6H_4)(PPh_3)H]^{2+}$ (phen is 1,10-phenanthroline), utilizing three different synthetic routes. The complexes have been characterized by NMR (^1H and ^{31}P) and by infrared spectroscopy. Initial results are reported on these photochemical and photophysical properties. The complexes of Os(II) represent rare examples of luminescent metal hydride complexes in fluid solution at room temperature.

11669 Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II). Sullivan, B.P.; Meyer, T.J. (Univ. of North Carolina, Chapel Hill). *Inorganic Chemistry;* **21**: No. 3, 1037-1040(1982). Contract AS05-78ER06034.

The complexes cis- and trans-Ru/sup II/$(dppm)_2Cl_2$ (dppm = $Ph_2PCH_2PPh_2$) have been found to undergo isomerization reactions induced by light, heat, or oxidation to Ru(III). The conver-

sion trans → cis occurs thermally while cis → trans occurs photochemically apparently by irradiation of the lowest lying d-d transition. Upon chemical or electrochemical oxidation of the cis isomer, the trans isomer of Ru(III) forms quantitatively. The cis isomer was found to be substitution labile in solvents that can act as ligands while the trans isomer is inert. Comparisons of the three-pathway isomerization of $Ru(dppm)_2Cl_2$ are also made with its osmium analogue and with the carbonyl complex $(N,N'\text{-}Me_2Im)_2W(CO)_4$.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 10781, 10782, 11176, 11601, 11608, 11620, 11630, 11657, 11659, 11661, 11663, 11665, 11668, 11669, 11706, 12090, 12124

11670 (AD-A—158333/5/XAB) Adsorption and desulfurization of thiophene on nickel(111). Schoofs, G.; Preston, R.; Benziger, J. (Princeton Univ., NJ (USA). Dept. of Chemical Engineering). 1985. 9p. NTIS, PC A02/MF A01.

The adsorption and desulfurization of thiophene on clean and sulfided Ni(111) surfaces were studied with LEED, AES, TPR, and RAIS. The RAIS data indicate that thiophene adsorbs with its ring parallel or nearly parallel to the surface below room temperature. On clean Ni(111), thiopene polymerizes slightly above room temperature, as evidenced by paraffinic and aromatic C-H stretches in the reflection infrared spectrum and TPR product yields. Decomposition of the polymer aggregates produces a wide variety of hydrocarbons including C5 fragments at 470 K. On a more acidic sulfided Ni(111) surface (Theta subscripts = 0.19), thiophene appears to undergo electrophilic attack at an alpha-carbon as evidenced by TPR products and by methane evolution from the reaction of 2,5-dimethylthiophene. An electrophilic attack by a surface metal atom at an alpha-carbon of thiophene is discussed in terms of molecular orbital theory.

11671 (DOE/ER/10339—2-Final) Studies of metal ammonia interactions with aromatic substrates. Final report, December 18, 1979-February 28, 1985. Rabideau, P.W. (Indiana-Purdue Univ., Indianapolis (USA). Dept. of Chemistry). Nov 1985. Contract AC02-79ER10339. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004207.

This report provides some highlights of the achievements accomplished during the contract period (December 18, 1979 to February 28, 1985) with emphasis on recent work. Major accomplishments lie in two areas, metal-ammonia reduction and reductive alkylation processes, and the conformational analysis of hydroaromatics. This includes the selective reduction of alkyl naphthalenes to 1,2-dihydro, 1,4-dihydro or tetrahydro reduction products, and the application of these techniques to dimeric naphthalenes serving as "coal models". We also demonstrated that the presence of water before metal addition has no negative effect on the reduction of polynuclear compounds. Moreover, added water was found to have an unusual, positive effect on the reduction of aromatic esters and allowed 1,4 ring reduction for the first time. We have also learned a great deal about the alkylation of benzylic anions including stereochemical and counterion effects. Finally, our proton and carbon NMR work, as well as empirical force field calculations with 1,4-dihydroaromatics has provided new thinking about the solution stereochemistry of these compounds. Our results suggest planar structures for a number of compounds heretofore considered to be "boat shaped". 23 refs., 3 figs.

11672 (DOE/ER/13175—7) Removal of n-alcohols from an aqueous stream using micellar-enhanced ultrafiltration. Gibbs, L.L. (Oklahoma Univ., Norman (USA). School of Chemical Engineering and Materials Science). 1985. Contract AS05-84ER13175. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004693.

This paper presents an experimental study of micellar-enhanced ultrafiltration (MEUF). MEUF is used to remove n-alcohols, hexanol, heptanol, and octanol, from an aqueous stream. The surfactant used was cetypyridinium chloride. Results show that MEUF is a viable separation technique for the removal of alcohols. Rejections as high as +98% for the alcohols and +99% for the surfactant were observed. Rejection of alcohol was found to increase with increasing chain length. The effects of concentration polarization were present in the study, but concentration polarization was found to improve the rejections. In at least one case, the alcohol in the MEUF permeate was found to deviate from that expected from equilibrium studies. 15 refs., 16 figs., 4 tabs.

11673 (DOE/ER/45193—T1) Synthesis and properties of novel electroactive organometallic polymers. Annual progress report, March 7-December 1, 1985. Rosenblum, M. (Brandeis Univ., Waltham, MA (USA)). 18 Dec 1985. Contract FG02-85ER45193. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004951.

This report describes the synthesis and crystal structure of 1,8-diruthenocenylnaphthalene and the preparation of the first oligomers based on this system. 3 refs., 2 figs. (PLG)

11674 (DOE/PC/60804—T9) Thermophysical properties correlations and pseudocomponent characterization parameter estimation for fossil fluids. First quarterly report (III year), September 1-November 30, 1985. Starling, K.E.; Lee, L.L.; Ellington, R.T.; Khan, M.A.; Mannan, M.; Sheth, K. (Oklahoma Univ., Norman (USA). School of Chemical Engineering and Materials Science). 1985. Contract FG22-83PC60804. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004544.

This report summarizes work performed during the period September 1, 1985 through November 30, 1985. During this period, a data bank for the viscosity of pure substances in the dense gas and liquid phase was developed. Different forms of correlations in the ratio form and in the residual form have also been studied. Testing on paraffinic hydrocarbons (5 straight-chain and 1 branched) indicates that correlation in the residual form is capable of describing the dense fluid viscosity data more accurately. A total of 1061 data points were used in testing the correlation with an overall average absolute relative deviation of 4.00%. A detailed description of the correlation is given in section-2. 24 refs., 6 figs., 2 tabs.

11675 Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts. Driscoll, D.J.; Lunsford, J.H. (Texas A and M Univ., College Station). *Journal of Physical Chemistry;* **89**: No. 21, 4415-4418(10 Oct 1985).

The formation of surface-generated gas-phase radicals during the reactions of methane, ethane, ethylene, and propylene over Bi_2O_3, $\gamma\text{-}Bi_2O_3$ x MoO_3, PbO, MgO, and Li/MgO was examined by EPR matrix isolation spectroscopy. Allyl radicals were detected during the reaction of propylene over all of the oxides examined. Gas-phase methyl and ethyl radicals were detected during the reactions of methane and ethane, respectively, over MgO and Li/MgO while Bi_2O_3, $\gamma\text{-}Bi_2O_3$ x MoO_3, and PbO were essentially inactive. Gas-phase vinyl radicals were not detected during the reaction of ethylene over any of the oxides. These differences in reactivity are attributed to differences in reactivity of the oxide ions on these surfaces towards hydrogen atom abstraction. 28 references, 1 figure.

11676 Solid state studies. 29. Crystalline urea: evidence for vibrational delocalization. Liapis, K.; Jayasooriya, U.A.; Kettle, S.F.A.; Eckert, J.; Goldstone, J.A.; Taylor, A.D. (Univ. of East Anglia, Norwich, England). *Journal of Physical Chemistry;* **89**: No. 21, 4560-4565(10 Oct 1985).

A comparison of single-crystal and mixed-crystal isotopomeric Raman, incoherent inelastic neutron scattering, and infrared data on crystalline urea indicates the inadequacies of an isolated-molecule approach to the interpretation of these spectra. 22 references, 4 figures, 4 tables.

11677 Theoretical and experimental study of the equation of state of tetrafluoromethane. Rubio, R.G.; Calado, J.C.G.; Clancy, P.; Streett, W.B. (Cornell Univ., Ithaca, NY). *Journal of Physical Chemistry;* **89**: No. 21, 4637-4646(10 Oct 1985). Contract AC02-79ER10422.

The density of tetrafluoromethane has been measured from 95 to 413 K and pressures up to 1100 bar. The results have been correlated in terms of the Strobridge equation of state, and the orthobaric density and enthalpy of varporization have been calculated and compared with results from the literature. The ability of

both a variational treatment (VIM) and a perturbation theory to predict the experimental values of density and configurational energy has been examined. 40 references, 8 figures, 5 tables.

11678 **Analysis of pseudouridine by fluorescence spectrometry.** Uziel, M.; Miller, G.; Moody, R.; Vo-Dinh, T. (Oak Ridge National Lab., TN). *Analytical Letters;* **18**: No. B15, 1821-1833(Sep 1985). Contract AC05-84OR21400.

Fluorescence spectral properties of pseudouridine, an important biological indicator, have been measured for the first time in this study. The fluorescence quantum yield is maximal in aqueous solution with pH values above 9 with spectral properties characteristic of 5 alkyl substituted uracil derivatives. Chromatographic analysis shows the fluorescence is associated only with the pseudouridine peak. The concentration dependence of fluorescence is linear from 4 to 45 micromolar at pH 11.5. The excitation maximum is about 295 nm and the emission is broad with a maximum at about 390 nm. Addition of pseudouridine to urine extracts gives a linear increase in fluorescence with increasing pseudouridine concentration.

11679 **Structure and thermochemistry of the van der Waals molecule C_6H_6xHCl and its photoion $(C_6H_6xHCl)^+$.** Walters, E.A.; Grover, J.R.; White, M.G.; Hui, E.T. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **89**: No. 18, 3814-3818(29 Aug 1985). Contract AC02-76CH00016.

The dissociation energy of the van der Waals complex C_6H_6xHCl was determined to be 4.79 +/- 0.12 kcal mol^{-1} by measurement of the difference between the threshold for the dissociative photoionization of the complex and the ionization potential of C_6H_6. This value is compared to potential well depths obtained by analysis of centrifugal distortion constants for the same complex. The photoionization efficiency function for the production of $(C_6H_6xHCl)^+$ from C_6H_6xHCl was obtained between 1280 and 1380 A. A weak threshold for direct ionization at 1357 +/- 7 A (9.14 +/- 0.05 eV) leads to a dissociation energy for $(C_6H_6xHCl)^+$ of 7.3 +/- 1.2 kcal mol^{-1}. The shape of the photoionization efficiency function is interpreted in terms of the involvement of the structure of the complex in the dissociation dynamics. Standard heats of formation are reported for C_6H_6xHCl (-10.4 kcal mol^{-1}) and $(C_6H_6xHCl)^+$ (204 kcal mol^{-1}). 16 references, 3 figures, 1 table.

11680 **Orientation of CH_3NC adsorbed on Ag(311).** Ceyer, S.T.; Yates, J.T. Jr. (National Bureau of Standards, Gaithersburg, MD). *Journal of Physical Chemistry;* **89**: No. 18, 3842-3845(29 Aug 1985).

The adsorption of methyl isocyanide on the Ag(311) surface at 95 K has been studied by high resolution electron energy loss spectroscopy (HREELS), electron stimulated desorption ion angular distribution (ESDIAD), and thermal desorption spectroscopy. Examination of the intensities of the loss features in the HREEL spectrum within the selection rule for a dipolar scattering mechanism and the behavior of the ESDIAD patterns as a function of coverage lead to the conclusion that CH_3NC adsorbs on Ag(311) with two orientations. The C/sub 3nu/ axis of the more strongly bound CH_3NC molecule is tilted toward the macroscopic surface. The more weakly bound state interacts through the σ orbital on the -N=C end of the molecule leading to the CH_3NC molecule bound with its C/sub 3nu/ axis perpendicular to the macroscopic surface. The thermal desorption data exhibit two peaks which correlate with these bonding geometries. 17 references, 4 figures, 1 table.

11681 **Variational calculations of rotational-vibrational energy levels of formaldehyde X $^1A_1$.** Maessen, B.; Wolfsberg, M. (Univ. of California, Irvine). *Journal of Physical Chemistry;* **89**: No. 18, 3876-3879(29 Aug 1985). Contract AS03-76ER70188.

Variational calculations of rotational-vibrational energy levels are carried out on H_2CO and D_2CO for $J \leqq 10$ within the framework of the Watson Hamiltonian. The potential function, written in valence displacement coordinates, is one used previously in calculations for J = 0. The basis functions are products of vibrational functions and symmetric top rotor functions, where the vibrational functions diagonalize the rotationless (J = 0) Hamiltonian. Integrations over normal coordinates are carried out numerically by Gauss-Hermite quadrature. Calculations for the vibrational ground state are compared with experimental observations. The importance of Coriolis interactions on the energy levels and wave functions is demonstrated. 10 references, 1 figure, 5 tables.

11682 **Redox reactivity of transition-metal phthalocyanines: ligand radical formation vs. metal center oxidation.** Geiger, D.K.; Ferraudi, G.; Madden, K.; Granifo, J.; Rillema, D.P. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **89**: No. 18, 3890-3894(29 Aug 1985).

The one-electron oxidations of cobalt(II), cobalt(III), copper(II), and nickel(II) tetrasulfophthalocyanine have been investigated by using stop-flow, pulse radiolysis, and photolysis techniques. The optical and ESR spectral data obtained in all cases are consistent with the primary formation of the ligand-centered radical cation. The rate constants for the oxidation of the Cu(II) Ni(II), and Co(III) complexes with Ce(IV) have been determined to be around 10^6 $M^{-1}s^{-1}$. In the case of the Co(II) complex, spectral changes detected in stop flow and pulse radiolysis experiments are consistent with the formation of the cobalt(II) phthalocyanine radical and its rapid conversion to the stable Co(III) species. The cobalt(III), copper(II), and nickel(II) phthalocyanine radicals disproportionate, resulting in the regeneration of the parent phthalocyanine, M/sup n+/(aq), and ligand degradation products. 26 references, 5 figures, 3 tables.

11683 **One-electron redox reactions in aqueous solutions of sulfite with hydroquinone and other hydroxyphenols.** Huie, R.E.; Neta, P. (National Bureau of Standards, Gaithersburg, MD). *Journal of Physical Chemistry;* **89**: No. 18, 3918-3921(29 Aug 1985).

The one-electron oxidation of hydroquinone and other hydroxyphenols by the sulfite radical, SO_3^-, and the peroxysulfate radical, SO_5^-, has been investigated along with the oxidation of sulfite by several phenoxyl radicals. Rate constants for the oxidation of hydroxyphenols by SO_3^- are small in neutral solution but increase dramatically in basic solution, in correspondence to the deprotonation of the hydroxyphenol. SO_5^- reacts with most hydroxyphenols at moderate rates ($k \sim 1\text{-}5 \times 10^6$ M^{-1} s^{-1}) in neutral solution. The phenoxyl radicals with higher redox potentials, from phenol, resorcinol, and phloroglucinol, were found to oxidize sulfite in neutral solutions. 23 references, 3 figures, 3 tables.

11684 **Structure and reactions of C_2H_4 adsorbed on small Pt clusters.** Wang, P.K.; Slichter, C.P.; Sinfelt, J.H. (Univ. of Illinois, Urbana). *Journal of Physical Chemistry;* **89**: No. 17, 3606-3609(15 Aug 1985). Contract AC02-76ER01198.

The authors have used NMR to determine the structure of C_2H_4 adsorbed at room temperature on small Pt clusters supported on alumina. They observe an ethylidyne species ($C\text{-}CH_3$), with a C-C bond length of 1.49 +/- 0.02 A. The CH_3 groups rotate freely about the C-C direction at 77 K. Up to 390 K, the C-C bond length remains the same, suggesting the same surface species. C-C bond scission takes place above 390 K, and is complete at about 480 K, forming predominantly single carbon atoms with no hydrogen attached and a small amount of CH_3 species, in contrast with CH or CH_2 species proposed to form on Pt(111) surfaces. 13 references, 5 figures.

11685 **Gas-phase reactions of atomic chlorine with vinyl chloride.** Iyer, R.S.; Rowland, F.S. (Univ. of California, Irvine). *Journal of Physical Chemistry;* **89**: No. 17, 3730-3737(15 Aug 1985). Contract AS03-76ER70126.

The reactions of chlorine atoms with CH^+CHCl have been investigated over the pressure range from 70 to 4000 torr by using radioactive ^{38}Cl atoms formed by neutron irradiation of $CClF_3$. The only observed product when $CH_2{=}CHCl$ is the sole substrate is $CH_2{=}CH^{38}Cl$ in yields varying from 1.35% at 4000 torr to 44.2% at 71-torr total pressure. With HI present as a second substrate, $CH_2ClCH_2{}^{38}Cl$ is observed as a major product with a yield as high as 78% at 4000-torr total pressure, and $CH_2CHCl^{38}Cl$ is also found in yields of 2% or less. A 1,2-chlorine atom migration is required in the overall mechanism, and two quite different kinetic schemes fit the observed yields of $CH_2{=}CH^{38}Cl$ and

$CH_2ClCH_2{}^{38}Cl$ very satisfactorily. The favored mechanism involves little initial preference for addition to the CH_2 or CHCl ends of $CH_2{=}CHCl$. The high yields of $CH_2ClCH_2{}^{38}Cl$ at high pressures are preceded by a 1,2-chlorine atom migration from collisionally stabilized $CH_2CHCl{}^{38}Cl$ radicals to form $CH_2{}^{38}ClCHCl$ or $CH_2ClCH{}^{38}Cl$ prior to abstraction of H from HI to form $CH_2ClCH_2{}^{38}Cl$. The absolute reaction rate for ^{38}Cl with $CH_2{=}CHCl$ has been estimated from its relative rate vs. reaction with HI to be about 1.5×10^{-10} cm^3 molecule^{-1} s^{-1}. 22 references, 4 figures, 2 tables.

11686 Effect of high pressure on the electron mobility in liquid n-hexane, 2,2-dimethylbutane, and tetramethylsilane. Munoz, R.C.; Holroyd, R.A.; Nishikawa, M. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **89**: No. 14, 2969-2972(4 Jul 1985). Contract AC02-76CH00016.

The mobility of excess electrons has been measured as a function of pressure to 3 kbar in three nonpolar liquids. For n-hexane the mobility decreases 56% from its 1-atm value, for 2,2-dimethylbutane a 33% increase is observed, and for tetramethylsilane a small (15%) decrease is observed. Different theories of electron transport are evaluated in light of these results. In the case of tetramethylsilane, the results are consistent with an electron transport process controlled by electrons moving in an extended state and undergoing occasional scattering by local changes in the energy of the bottom of conduction band caused by density fluctuations. 19 references, 3 figures, 1 table.

11687 Effects of molecular organization on photophysical behavior: lifetime and steady-state fluorescence of chlorophyll a singlets in monolayers of dioleoylphosphatidylcholine at the nitrogen-water interface. Agrawal, M.L.; Chauvet, J.P.; Patterson, L.K. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **89**: No. 14, 2979-2982(4 Jul 1985).

The fluorescence lifetimes of the chlorophyll a singlet have been measured in spread monolayers of dioleoylphosphatidylcholine at the nitrogen-water interface. Determinations were made as functions of both chlorophyll concentration and compression. A single exponential decay with a lifetime of 5.5 +/- 0.3 ns was observed at 0.0084 mole fraction chlorophyll; this falls to 1.0 +/- 0.1 ns at 0.0800 mole fraction. Such findings indicate a limiting quantum yield approaching that found in isotropic polar media as well as vesicles; it is about 90% of that found in nonpolar media. Fluorescence and excitation spectra have also been obtained. An unstructured fluorescence band is observed with a maximum at 678.5 +/- 0.5 nm, indicating the monomer is the predominant fluorescent form of chlorophyll a. Fluorescence intensity data in the same concentration range are presented for comparison. Plots of both intensity and lifetime, normalized to values obtained at infinite dilution, as functions of molecules/cm^3, coincide quite closely. The agreement between these two types of data - while indicating that statistical chlorophyll a pairs are involved in the quenching mechanism - suggests that both fluorescence and energy transfer from such pairs compete with the process of quenching. 22 references, 4 figures.

11688 Multiresonant four-wave mixing spectroscopy of pentacene in naphthalene. Chang, T.C.; Johnson, C.K.; Small, G.J. (Iowa State Univ., Ames). *Journal of Physical Chemistry;* **89**: No. 14, 2984-2992(4 Jul 1985). Contract W-7405-ENG-82.

Dispersive multiresonant coherent anti-Stokes and Stokes (CARS and CSRS) data are reported for pentacene in naphthalene. The vibronic resonances are associated with the lowest excited singlet state of pentacene. Attention is focused on the 755-cm^{-1} ground-state fundamental of pentacene, its excited-state counterpart at 747 cm^{-1}, and their two partners which move with the detuning, d, of the omega$_1$ laser away from the electronic origin transition at omega/sub 0'0/(d=omega$_1$-omega/sub 0'0/). Pentacene in naphthalene appears to be unusual in that excited electronic state CARS resonances are observed for negative detunings which are large relative to the inhomogeneous linewidth of the omega/sub 0'0/ transition. Temperature-dependent studies indicate that the excited-state population mechanism involves phonon hot band absorption. CARS and CSRS data are presented which are consistent with line narrowing for the 755-cm^{-1} resonance. The observed line widths for the 755- and 747-cm^{-1} resonances, when corrected for the laser contributions, yield vibrational dephasing times somewhat shorter (~20%) than the values obtained from time-domain studies. In connection with the site inhomogeneity problem, some CARS and CSRS data are also presented for cresyl violet in poly(acrylic acid). 45 references, 9 figures, 5 tables.

11689 Phosphorescence line narrowing of coronene and phenanthrene adsorbed on cellulose substrates. Vo-Dinh, T.; Suter, G.W.; Kallir, A.J.; Wild, U.P. (Oak Ridge National Lab., TN). *Journal of Physical Chemistry;* **89**: No. 14, 3026-3030(4 Jul 1985). Contract AC05-84OR21400.

Phosphorescence line narrowing (PLN) of phenanthrene and coronene adsorbed on cellulose (filter paper) substrates was observed for the first time. The 457.9- and 514.5-nm lines of an argon ion laser were used to directly excite into the T_1 withdraws S_0 transitions of the molecules. The transition probability was enhanced by the external heavy-atom effect of thallium acetate impregnated on the filter paper substrate. Measurements were conducted from 4 to 300 K to investigate the effects of temperature on the phosphorescence bandwidths and to provide qualitative information on the extent of electron-phonon coupling of the guest-host systems. The phosphorescence quantum yield was not found to be significantly temperature dependent. 15 references, 6 figures.

11690 High-pressure study of rhodamine B in solution and adsorbed on oriented single-crystal ZnO. Roberts, E.R.; Drickamer, H.G. (Univ. of Illinois-Champaign, Urbana). *Journal of Physical Chemistry;* **89**: No. 14, 3092-3095(4 Jul 1985). Contract AC02-76ER01198.

The effect of hydrostatic pressure to 10 kbar has been measured on the spectrum of rhodamine B in buffered aqueous solution (2×10^{-5} M) and adsorbed on the 0001 face of single-crystal ZnO in equilibrium with the solution. The dye exists as a mixture of monomer and dimer, both in solution and adsorbed. The monomer and dimer peaks shift to lower energy with increasing pressure in both environments as is characteristic of π-π^* excitations. From the monomer-dimer equilibrium constant in solution one finds a decrease in volume on dimerization. At low pressure Δ anti V = -4.2 cm^3/g-mol, while at high pressure Δ anti V = -5.1 cm^3/g-mol. The monomer showed virtually no decrease in volume with adsorption. The dimer exhibited a smaller partial molar volume when adsorbed than in solution (Δ anti V = -1.2 cm^3/g-mol at low pressure and -0.4 cm^3/g-mol at high pressure). The volume change for the process from monomers in solution to adsorbed dimers is essentially independent of pressure. 12 references, 7 figures.

11691 ESR study of the dissociation of hydroxyl protons in hydroxycyclohexadienyl radicals. Taniguchi, H.; Schuler, R.H. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **89**: No. 14, 3095-3101(4 Jul 1985).

The hydroxylic protons of a number of carboxylated hydroxycyclohexadienyl radicals are shown by ESR methods to undergo acid dissociation with pK/sub a/ values in the range 13.5-15.3. For these radicals ionization of the hydroxylic proton has very little effect on the g factor and appreciably affects the hyperfine constants only of the protons at the methylenic position. For radicals carboxylated at positions adjacent to the OH group these latter constants (a(H_α)) decrease by as much as 4 G on ionization, in contrast to increases of 2-4 G observed for hydroxycyclohexadienyl and the more remotely carboxylated radicals. The acid-base equilibria can, in each case, be monitored by examining the basicity dependence of a(H_α). Comparison of the pK/sub a/ values of the three radicals derived from benzoic acid shows that hydrogen bonding between OH and an adjacent carboxyl group increases the pK/sub a/ by ~0.7 unit. For the more highly carboxylated radicals the effects are shown to be nearly additive if one includes an additional term representing charge stabilization of the anionic form of the radical. These interactions have, however, only a negligible effect on electron distribution in the π systems of the radical, as is indicated by the lack of dependence of the hyperfine constants on ionization. 17 references, 5 figures, 1 table.

11692 Ionic dissociation of hydroxycyclohexadienyl radical: effect on ^{13}C hyperfine splittings. Lefcourt, M.; Madden, K.P.; Schuler, R.H. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **89**: No. 14, 3101-3102(4 Jul 1985).

The ^{13}C hyperfine constants of 1,2,4,5-tetracarboxyhydroxycyclohexadienyl radical are shown to be substantially unaffected by ionization of the hydroxyl group. This result, which contrasts with the large decrease noted in $a(H_6)$, implies that the relatively low values for $a(H_6)$ observed in hydroxycyclohexadienyl radicals and their anions result not from distortion of the radical at the C_6 site but rather from perturbation of the wave function at H_6 by the OH or O^- group. 4 references, 2 figures, 1 table.

11693 Mechanism of tritium-atom promoted isotope exchange in the benzene ring. 2. Substituent effects and a crossover in labelling mechanism. Powell, M.F.; Lemmon, R.M. (Lawrence Berkeley Lab., CA). *Journal of Physical Chemistry;* **89**: No. 14, 3179-3182(4 Jul 1985). Contract AC03-76SF00098.

Reaction of tritium atoms, generated by microwave activation of T_2 gas, with substituted benzenes was studied at ~-50°C. The tritiations were usually carried out with a 1:1 mole mixture of the desired phenyl compound and toluene. Both relative labeling yields (with benzene = 1 as a reference) and product isotope effects were determined; these were used to support a crossover in labeling mechanism from predominantly addition-elimination (as in benzene-t) to a hot-atom multiple-tritium addition (as takes place in xylene-t). The contribution of each labeling pathway could be controlled by varying the distance between the microwave discharge cavity and the sample; shorter distances gave hotter tritium atoms at the sample, resulting in less selectivity but higher labeling yields. 12 references, 1 figure, 2 tables.

11694 Deuterium isotope effects in condensed-phase thermochemical decomposition reactions of octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine. Shackelford, S.A.; Coolidge, M.B.; Goshgarian, B.B.; Loving, B.A.; Rogers, R.N.; Janney, J.L.; Ebinger, M.H. (Air Force Rocket Propulsion Lab., (AFSC), Edwards AFB, CA). *Journal of Physical Chemistry;* **89**: No. 14, 3118-3126(4 Jul 1985).

The deuterium isotope effect was applied to condensed-phase thermochemical reactions of HMX and HMX-d_8 by using isothermal techniques. Dissimilar deuterium isotope effects revealed a mechanistic dependence of HMX upon different physical states which may singularly predominate in a specific type of thermal event. Solid-state HMX thermochemical decomposition produces a primary deuterium isotope effect (DIE), indicating that covalent C-H bond rupture is the rate-controlling step in this phase. An apparent inverse DIE is displayed by the mixed melt phase and can be attributed to C-H bond contraction during a weakening of molecular lattice forces as the solid HMX liquefies. The liquid-state decomposition rate appears to be controlled by ring C-N bond cleavage as evidenced by a secondary DIE and higher molecular weight products. These results reveal a dependence of the HMX decomposition process on physical state and lead to a broader mechanistic interpretation which explains the seemingly contradictory data found in current literature reviews. 33 references, 9 figures, 5 tables.

11695 Effects of cation-induced and pH-induced membrane stacking on chlorophyll fluorescence decay kinetics. Karukstis, K.K.; Sauer, K. (Lawrence Berkeley Lab., CA). *Biochimica et Biophysica Acta;* **806**: 374-388(1985). Contract AC03-76SF00098.

The effects of thylakoid membrane appression by electrostatic screening and by charge neutralization on the room-temperature chlorophyll fluorescence decay kinetics of broken spinach chloroplasts have been compared. Monovalent and divalent metal cations induce both a structural differentiation of thylakoid membranes and a lateral segregation of pigment-protein complexes. These phenomena have distinct effects on the F_0- and F/sub max/-level chlorophyll fluorescence decay kinetics at different levels of added cation. Specific cation effects, particularly on a 1-2 ns decay component at the F/sub max/ fluorescence level, that are proposed to be related to the effectiveness of electrostatic screening as determined by the hydrated metal ionic radius were noted. Distinct pH-induced effects on chlorophyll fluorescence decay kinetics are associated with the alternative mechanism of electrostatic neutralization to induce membrane stacking. These observations are used to construct a model of chlorophyll fluorescence emission that accounts for the variable kinetics and multiexponential character of the fluorescence decay upon membrane appression.

11696 Oxidation of arenes by molten gallium(III) chloride. Dworkin, A.S.; Brown, L.L.; Buchanan, A.C. III, Smith, G.P. (Oak Ridge National Lab., TN). *Tetrahedron Letters;* **26**: No. 23, 2727-2730(1985). Contract AC05-84OR21400.

Molten, anhydrous Ga_2Cl_6 at 100-130°C readily oxidizes pyrene, anthracene and naphthacene with the concomitant reduction of Ga(III) to Ga(I). Dilute solutions of these arenes (ArH) are oxidized to their radical cations (ArH^+), which decay very slowly in Ga_2Cl_6, while more concentrated solutions are oxidized to stable arenium ions (ArH_2^+) with hydrogen derived from aryl-aryl coupling reactions.

11697 Circular and flip-flop hydrogen bonding in β-cyclodextrin undecahydrate: neutron diffraction study. Betzel, C.; Saenger, W.; Hingerty, B.E.; Brown, G.M. (Freie Universitaet Berlin, West Germany). *Journal of the American Ceramic Society;* **106**: No. 24, 7545-7557(1984). Contract W-7405-ENG-26.

Crystal parameters have been determined by x-ray studies for β-cyclodextrin undecahydrate (β-CD 11 H_2O) crystallized from water in a monoclinic space group P2. Two crystal forms were detected that differ slightly in unit cell constants and more significantly in the number of 11 and 12 water molecules associated with the β-cyclodextrin. Results of neutron-diffraction analysis to determine the hydrogen bonding scheme in the β-CD 11 H_2O are presented.

11698 (UCRL-Trans—12081) New method of synthesizing stilbene compounds with heterocyclic substituents, anil synthesis. Siegrist, A.E. Translated from *Helvetica Chimica Acta ;* **50**: 906-957(1967). Contract W-7405-ENG-48. 93p. NTIS, PC A05. File Number DE86004813.

Heterocyclic ring systems with an aromatic character and at least one ring nitrogen which contain one or more p-tolyl groups or a methyl group in p position to a -C=N or -N=C group of the heterocycle in a benzene ring condensed onto the heterocycle can be reacted with aromatic aldehyde anils in dimethylformamide in the presence of potassium hydroxide or potassium tert-butylate to form stilbene compounds with heterocyclic substituents. 70 refs., 73 tabs.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 11602, 11638

11699 (LBL—20025) Optical and electrochemical study of model zinc electrode pores in alkaline electrolyte. Flatt, J.H.; McLarnon, F.R.; Cairns, E.J. (Lawrence Berkeley Lab., CA (USA)). Sep 1985. Contract AC03-76SF00098. 179p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86002967.

A computer-controlled model single-pore cell has been developed to study zinc electrode discharge behavior in alkaline electrolytes. The cell design allows for simultaneous microscopic and potential performance observations. A quartz-supported, thin-film cadmium reference microelectrode was designed, fabricated and installed in the cell. The cell was designed to create model pores of dimensions comparable to those in commercial zinc electrodes. Zinc electrode discharge behavior was studied in pores of effective radii between 14 and 20 microns at 7 mA/cm², 30 mA/cm² and 1250 mA/cm² rates of discharge in 7.7M KOH electrolyte. Results are consistent with a dissolution-precipitation discharge reaction mechanism. SEM studies showed significant variations in electrode surface morphology with location in the pore and rate of discharge. Significant pore [OH^-] gradients, with slow relaxation times, were found to exist within the pore at the 30 mA/cm² rate. Passivation was observed at the 1250 mA/cm² rate. Zinc electrode discharge

behavior in 3.5M KOH-3.4M KF showed a similar discharge reaction mechanism. However, earlier surface film formation in 3.5M KOH-3.4M KF was found to occur. Initial reaction penetration depths in 7.7M KOH and 3.5M KOH-3.4M KF electrolytes were 0.11 cm and 0.10 cm.

11700 **(SAND—85-0015) Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes.** Delnick, F.M.; Cieslak, W.R. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1985. Contract AC04-76DP00789. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86003987.

The oxidation of 1.5 M $LiAlCl_4/SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes is evaluated using complex impedance and steady-state polarizations. All four metals behave as inert, film-free electrodes in the $SOCl_2$ electrolyte with the same differential double-layer capacitance of 11 to 12 $\mu F/cm^2$ at $E \geqq 4.7$ V vs. Li/LiCl.

11701 **Ultra high vacuum electrochemistry with conducting polymers.** Skotheim, T.A.; Florit, M.I.; Melo, A.; O'Grady, W.E. (Brookhaven National Lab., Upton, NY). *Molecular Crystals and Liquid Crystals;* **121**: 291-295(1985). Contract AC02-76CH00016.

Solvent free polymer solid electrolytes based on high molecular weight poly(ethylene oxide) (PEO) complexed with alkali metal salts are compatible with ultrahigh vacuum (UHV). This was taken advantage of in the design of electrochemical cells for electrochemical synthesis as well as reduction/oxidation of polypyrrole in UHV. This allows in situ application of surface spectroscopies (XPS) to study the material as a function of its state of oxidation. 7 references, 3 figures.

4005 Photochemistry

REFER ALSO TO CITATION(S) 10988, 11642, 11668

11702 **(DOE/ER/13023—2) Investigations on multiphoton ionization and laser-ion beam photodissociation spectroscopy. Final report.** Russell, D.H. (Texas A and M Univ., College Station (USA). Dept. of Chemistry). 1984. Contract AS05-82ER13023. 18p. NTIS, PC A02. File Number DE86005070.

The research progress summary will be divided into two sections. The first section will deal with the development of a laser-ion beam photodissociation apparatus at TAMU, and the second section will summarize the results of studies on model ionic systems. The model systems studied were selected to evaluate the potential of laser-ion beam photodissociation (LIBP) for probing the fundamental properties of gas phase ionic systems as well as the potential analytical utility of the method. It should be understood that the title of this project is somewhat misleading, i.e., the original proposal dealt with ion chemistry studies employing both multiphoton ionization and laser-ion beam photodissociation. However, due to the funding level provided by DOE, Office of Basic Energy Sciences, it was not feasible to pursue both research areas. At the time a contract was awarded we had an argon ion laser in our laboratory which was suitable for the laser-ion beam photodissociation studies; consequently, it was this area of the research which we chose to emphasize. 6 refs., 2 figs.

11703 **Electron spin resonance study of chlorophyll a cation radical in photoirradiated frozen vesicle solutions with or without electron scavengers.** Ohta, N.; Kevan, L. (Univ. of Houston, TX). *Journal of Physical Chemistry;* **89**: No. 14, 3070-3076(4 Jul 1985). Contract AS05-80ER10745.

Electron spin resonance (ESR) studies of chlorophyll a (Chla) cation radical ($Chla^+$) produced by photoirradiation have been carried out in frozen DL-α-dipalmitoylphosphatidylcholine (DPPC) vesicle solutions with and without electron scavengers. Photoinduced $Chla^+$ was observed by ESR in DPPC vesicle solutions with electron scavenger at 77 K for the first time. In the presence of an electron scavenger, simultaneous photoinduced formation of $Chla^+$ and some scavenger anions was observed. $Chla^+$ formation mechanisms are discussed. 23 references, 11 figures, 3 tables.

11704 **Moessbauer study of the kinetics of Fe^{3+} photoreduction on TiO_2 semiconductor powders.** Brown, J.D.; Williamson, D.L.; Nozik, A.J. (Colorado School of Mines, Golden). *Journal of Physical Chemistry;* **89**: No. 14, 3076-3080(4 Jul 1985). Contract AC02-83CH10093.

The kinetics of the photoreduction of Fe^{3+} to Fe^{2+} via illuminated TiO_2 particles suspended in ferric chloride electrolyte has been studied by ^{57}Fe Moessbauer spectroscopy. The semiconductor powder-liquid electrolyte slurry was quench-frozen after specific illumination periods to generate samples amenable to Moessbauer spectroscopy. The rates and equilibrium conversion of Fe^{3+} reduction were obtained for five TiO_2 particle-electrolyte systems: (1) intrinsic anatase powder; (2) intrinsic rutile powder; (3) intrinsic anatase powder with a facile hole acceptor added to the electrolyte; (4) reduced, n-type anatase; and (5) platinized, n-type anatase powder. A simple kinetic model, based on competition between the forward reduction of Fe^{3+}, and controlled by semiconductor band/redox couple energetics, is able to account for the observed differences in Fe^{3+} photoreduction for the five systems. 26 references, 5 figures, 2 tables.

11705 **Determination of the amount and the type of quinones present in single crystals from reaction center protein from the photosynthetic bacterium Rhodopseudomonas viridis.** Gast, P.; Michalski, T.J.; Hunt, J.E.; Norris, J.R. (Argonne National Lab., IL). *FEBS (Federation of European Biochemical Societies) Letters;* **179**: No. 2, 325-328(Jan 1985). Contract W-31-109-ENG-38.

The identity and amount of quinone in single crystals from reaction center protein from Rhodopseudomonas viridis have been determined using high-performance liquid chromatography (HPLC), optical spectroscopy and mass spectrometry. The ratio menaquinone-9/ubiquinone-9 for solutions of reaction center protein of Rps. viridis was 0.93 +/- 0.05. After crystallization of the reaction center solution, the quinone ratio was 1.6 +/- 0.1. These observations show that about half of the ubiquinone-9 can be lost during crystallization.

11706 **Steady-state and laser flash photolysis studies of bridgehead-substituted dibenzobarrelenes.** Murty, B.A.R.C.; Pratapan, S.; Kumar, C.V.; Das, P.K.; George, M.V. (Indian Institute of Tech., Kanpur). *Journal of Organic Chemistry;* **50**: No. 14, 2533-2538(1985).

The photochemistry of bridgehead-substituted dibenzobarrelenes has been investigated by steady-state photolysis, product analysis, and time-resolved laser flash photolysis. 4b-Substituted dibenzosemibullvalenes are formed as major photoproducts from dibenzobarrelenes, bearing acetoxy, formyl, ethyl, and methoxy 9-bridgehead substitutents, whereas 8b-substituted dibenzosemibullvalenes (or products derived from them) are formed from 9-hydroxy- and 9-cyano-substituted dibenzobarrelenes. Laser flash photolysis gives rise to transient phenomena attributable to the triplets of dibenzobarrelenes (phi/sub T/ = 0.2-0.7 in benzene). These are characterized by broad and diffuse absorption spectra, short lifetimes (0.07-11 +s), and varying degrees of quenchability by azulene, ferrocene, β-cartene, and p-methoxyphenol. The rate constants for triplet quenching by the latter quenchers as well as oxygen and di-tert-butylnitroxy radicals are presented.

11707 **Photophysical behaviors of N-methylthioacridone triplet and efficiency of singlet oxygen generation from its quenching by oxygen.** Kumar, C.V.; Davis, H.F.; Das, P.K. (Univ. of Notre Dame, IN). *Chemical Physics Letters;* **109**: No. 2, 184-189(10 Aug 1984).

Kinetic and absorption-spectral behaviors of N-methylthioacridone triplet suggest its utility as a reference and a sensitizer under photoexcitation in the visible. The efficiency of singlet oxygen production as a result of triplet quenching by oxygen is essentially unity in polar and non-polar solvents.

11708 **Electric field assisted dissociation of charge transfer states as a mechanism of photocarrier production.** Braun, C.L. (Dartmouth College, Hanover, NH). *Journal of Chemical Physics;* **80**: No. 9, 4157-4161(1 May 1984). Contract AC02-83ER13102.

The lowest charge-transfer excited state (CT_1) of electron donor-acceptor crystals or polymers is demonstrated to be a plausible precursor of free charge carriers when such materials are photoexcited. Rate constants for the dissociation of charge-transfer states are formulated for two approximate descriptions of CT_1: classical ion pair and Wannier exciton. The electric field dependence of the dissociation rate constant is postulated to be given by Onsager's 1934 theory (O-34) of ion pair dissociation. This formulation of CT_1 dissociation obviates the need to invoke electron-hole thermalization lengths of 2 to 3 nm in order to explain free charge carrier formation in donor-acceptor materials.

11700 **Laser photolysis of 2-phenylheptamethyltrisilane.** Gaspar, P.P.; Boo, B.H.; Chari, S.; Ghosh, A.K.; Holten, D.; Kirmaier, C.; Konieczny, S. (Washington Univ., Saint Louis, MO). *Chemical Physics Letters;* **105**: No. 2, 153-157(9 Mar 1984).

Two transient absorptions have been detected in the 266 nm laser photolysis of 2-phenylheptamethyltrisilane in cyclohexane solution at room temperature, and their time evolution was recorded in the presence and absence of air and added trapping agents. The shorter-lived 440 nm transient with a half-life equal to less than 20^+ s is tentatively assigned to the silylene: SiMePh and the more persistent 380 nm transient to the disilene MePhSi=SiMePh. The reactivity of this silylene is much lower than had been expected.

11710 **Measurement of the $C_2(a^3PI/sub\ u/)$ and $C_2(X^1\Sigma/sub\ g/^+)$ disappearance rates with O_2 from 298 to 1300 kelvin.** Baughcum, S.L.; Oldenborg, R.C. (Los Alamos National Lab., NM). *ACS Symposium Series;* No. 249, 257-266(1984).

As an aid to assessing various reactions in combustion and similar high temperature processes, studies have been carried out on the C_2 radical, which is known to exist in high concentrations in flame and other combustion environments. A detailed description of a cell in which the temperature can be continuously varied over the 298-1300 K temperature range is presented. The C_2 was produced by multiple-photon dissociation of CF_3CCCF_3 at 193 nm and probed by laser-induced fluorescence. The reaction of C_2 with O_2 was studied as a test of the apparatus and to further evaluate the model proposed by Mangir and coworkers, which predicted non-Arrhenius behavior of the disappearance rate constants.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 11031, 11679, 11691, 11692

11711 (IAEA-TC—427/6, pp 7-9) **Formation of hydrogen in the radiolysis of water in closed volumes.** Kabakchi, S.A.; Lebedeva, I.E. (AN SSSR, Moscow. Inst. Fizicheskoj Khimii). Sep 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE86780327. (CONF-8309265—; TC-SR—2).

From IAEA specialists meeting on hydrogen behaviour and control and related containment loading aspects; Suzdal, USSR (19 Sep 1983).

Translated from Russian.

By applying the sum total of the elementary reactions involving short-lived particles it is possible to fairly accurately calculate the kinetics of hydrogen formation and of its separation from water, and also to calculate the accumulation of hydrogen peroxide and oxygen during radiolysis of pure water and water solutions at room temperature. This paper describes a semi-empirical method to calculate the kinetics of hydrogen formation for certain cases encountered in nuclear power production.

11712 (IAEA-TECDOC—337, pp 19-30) **Effect of gamma radiation on various inorganic ion exchangers.** Szirtes, L. (Magyar Tudomanyos Akademia, Budapest. Izotopintezete). Jul 1985. NTIS (US Sales Only), PC A13/MF A01. File Number DE86700463. (CONF-8406123—).

From IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle; Vienna, Austria (12 Jun 1984).

The effect of gamma radiation in the range of 5×10^3 to 10^7 Gy has been studied for the following inorganic ion-exchangers: amorphous zirconium, titanium and chromium phosphates, zirconium tellurate and crystalline zirconium and cerium phosphates. The solubility in acidic solutions, the ion-exchange capacity and the specific surface area of these compounds were examined before and after irradiation. Zirconium phosphate has a very stable crystalline structure which remains unchanged during the irradiation process. The crystal lattice of cerium arsenates is partly destroyed during irradiation, but the relatively high stability of the bands of AsO^{3-} groups prove that no chemical change accompanies this process. The cerium phosphate crystal is completely destroyed and becomes amorphous after irradiation.

11713 **(ZfI-Mitt—97) Third working meeting on radiation interaction. 1.** Schmidt, J.; Brede, O.; Doellstaedt, R.; Mehnert, R. (eds.). (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Dec 1984. 401p. (CONF-8409152—Pt.1). NTIS (US Sales Only), PC A18/MF A01. File Number DE86700470.

From 3. working meeting on radiation interaction; Leipzig, German D.R. (24 Sep 1984).

The following topics have been discussed during the meeting: elementary processes in radiation chemistry and physics (theory, inorganic and organic systems); applied radiation chemistry and radiation processing; techniques, methods and instrumentation used in radiation chemistry and radiation processing; and irradiation of food, agricultural products, pharmaceutical products, domestic and industrial wastes. 52 papers are included in part 1.

11714 **(ZfI-Mitt—98) Third working meeting on radiation interaction. 2.** Schmidt, J.; Brede, O.; Doellstaedt, R.; Mehnert, R. (eds.). (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Dec 1984. 409p. (CONF-8409152—Pt.2). NTIS (US Sales Only), PC A18/MF A01. File Number DE86700471.

From 3. working meeting on radiation interaction; Leipzig, German D.R. (24 Sep 1984).

The following topics have been discussed during the meeting: elementary processes in radiation chemistry and physics (theory, inorganic and organic systems); applied radiation chemistry and radiation processing; techniques, methods and instrumentation used in radiation chemistry and radiation processing; and irradiation of food, agricultural products, pharmaceutical products, domestic and industrial wastes. 55 papers are included in part 2.

11715 **ESR evidence for localized forms of C-C ring-opened oxirane radical cations.** Qin, X.Z.; Snow, L.D.; Williams, F. (Univ. of Tennessee, Knoxville). *Journal of Physical Chemistry;* **89**: No. 17, 3602-3606(15 Aug 1985).

Localized forms of the C-C ring-opened oxirane and methyl-substituted oxirane radical cations have been detected by ESR spectroscopy following γ-irradiation of solid solutions of the parent compounds in the $CFCl_3CF_2Cl$ matrix. For oxirane, 1,2-dimethyloxirane, and tetramethyloxirane, the localized forms possess the RCH_2, RCHMe, and the $RCMe_2$ radical centers, respectively. In the unsymmetrically substituted methyloxiranes, the radical center is localized at the oxirane carbon with the least number of methyl groups. The temperature needed to bring about the formation of the localized species increases with methyl substitution at the localized radical center, the oxirane and methyloxirane species being formed during irradiation at 77 K while the tetramethyloxirane species is produced subsequently from the delocalized planar form of the ring-opened cation at 105-110K. In contrast, only the delocalized forms of the oxirane cations have been observed in $CFCl_3$, CF_2CCl_2, and CCl_4, even at much higher temperatures (145-215 K) close to the softening points of these matrices. The possible structures of the localized forms of the oxirane radical cations are discussed. 29 references, 4 figures, 2 tables.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 11267, 11619, 11973

11716 **(AAEC/E—599) Zirconium molybdate gel as a generator for technetium-99m.** Evans, J.V.; Shying, M.E. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Dec 1984. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700466.

A new sup(99m)Tc generator based on zirconium molybdate gel is described. Essentially the gel is a cation ion exchanger which permits the elution of the pertechnetate ion. The high molybdenum content of this gel, its stability under self-irradiation, and the absence of organic materials during preparation provide a generator concept that eliminates high processing costs, active waste storage costs and stability problems in other types of generators.

11717 **(IAEA-SM—247/19) Detection and quantitation of left-to-right shunting by iridium-191m angiography.** Treves, S.; Cheng, C.; Samuel, A.; Fuji, A.; Lambrecht, R. (Harvard Medical School, Boston, MA (USA); Children's Hospital Medical Center, Boston, MA (USA); Massachusetts Inst. of Tech., Cambridge (USA); Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 6p. (CONF-800937—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005121.

From International symposium on medical radionuclide imaging; Heidelberg, F.R. Germany (1 Sep 1980).

An osmium-191→iridium-191m radionuclide generator suitable for first-pass angiography has been developed. Osmium-191 with a physical half-life of 15.4 days is produced in the reactor by the $^{190}Os(eta, \gamma)^{191}Os$ reaction and decays by internal conversion to $^{191}Ir/sup\ m/$. Iridium-191m has a physical half-life of 4.96 s and decays by isometric transition to stable ^{191}Ir. It emits a gamma ray at 129 keV with 30% abundance. In addition, x-rays at about keV in 58% abundance are emitted as a result of internal conversion from the 129 keV excited state. Osmium-191 metal is converted into potassium osmate, which is loaded into a column of 0.9 ml of AGMP-1 anion exchange resin. This column is connected in series to another column also of 0.9 ml of Dowex-2 and pyrocatechol. The generator is eluted with 0.6 to 1 ml of 0.9% NaCl, pH 1. One ml of eluant yields 7 to 10% of the $^{191}Ir/sup\ m/$ in the column and there is a 3 to 5% x 10^{-3}% of ^{191}Os breakthrough. The eluant is rapidly diluted and flushed with a buffer solution (25% 0.05M Na_2HPO_4, 75% 0.9% NaCl) before injection. The lowest pH delivered is 3.5. First-pass radionuclide angiography has been carried out in 59 patients ranging from four days to 67 years of age (mean = 14 years) for detection and quantitation of left-to-right shunting. Twelve patients underwent cardiac catheterizations with simultaneous $^{191}Ir/sup\ m/$ angiography. They had pulmonary-to-systemic ratios (Qp:Qs) ranging from 1.04 to 3.00. The major advantages of $^{191}Ir/sup\ m/$ are low radiation dose to patients high photon flux and the possibility of obtaining repeated studies within a short time. 22 refs., 3 figs.

11718 (INIS-mf—10007, pp 78-90) **Decontamination of nuclear power plant equipment.** Bar, J. 1983. (In Czech). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780343. (CONF-8310412—).

From Decontamination workshop; Rez, Czechoslovakia (4 Oct 1983).

The main sources and components of radioactive contamination in nuclear power plants are corrosion products, fission products, nuclear fuel and possibly radioactive sodium. The operating equipment of nuclear power plants with WWER reactors is decontaminated with aqueous decontamination solutions at a certain temperature possibly by circulating the solution in a closed circuit. Decontamination solutions may be: 1. alkaline oxidation solutions, e.g., the solution of alkaline permanganate, sodium nitrate, etc., which are used for removing deposits from stainless steel surfaces; 2. acid solutions which are usually used for removing deposits from carbon steel and aluminium surfaces; 3. solutions based on oxalic acid and hydrogen peroxide which are usually used for the first decontamination step in case of contamination with nuclear fuel. Examples are given of prescriptions for decontamination solutions. The equipment of nuclear power plants with sodium cooled reactors may be decontaminated using nonradioactive sodium, radioactive substances are trapped in the cold trap. Decontamination using suitable aqueous decontamination solutions is also described.

11719 (INIS-mf—10007, pp 91-94) **Decontamination of nuclear power plant equipment with chlorinated hydrocarbon-based solutions and emulsions.** Bar, J. 1983. (In Czech). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780343. (CONF-8310412—).

From Decontamination workshop; Rez, Czechoslovakia (4 Oct 1983).

A method of decontamination is given using solvents or emulsions containing tetrachloroethylene or trichloroethylene; effective decontamination agents such as HNO_3, tetrasodium salt of EDTA; and substances forming a solution of the said components (butanol) or an emulsion (oleic acid, triethanolamine, etc.). After decontamination the used solution or emulsion is divided into two phases: the slightly radioactive solvent and the highly active aqueous phase. The two phases are then decontaminated and an organic solvent is used for the preparation of new decontamination means. Examples are given of the chemical composition of decontamination solutions and emulsions tested in the laboratory.

11720 **(JINR—6-84-609) Simple method of ^{111}In high temperature isolation from silver.** Novgorodov, A.F.; Bajer, G.Yu.; Zelinski, A.; Kolachkovski, A.; Shomeker, K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700467.

Submitted to the journal Radiochemistry.

The method of ^{111}In isolation from irradiated silver is suggested. The above method is based on high-temperature indium transformation into the gaseous phase containing different mixtures of HCl and H_2O. The target made of natural silver was irradiated by 28 MeV α-particles. Gaseous mixtures of HCl and H_2O with elasticity ratio of approximately 1/10, 1/1, and 10/1 were used for chlorization. All experiments were conducted in the quartz equipment at target material temperature of 1315 +- 20 K. It is shown that indium isolated in the gaseous phase forms at least three compounds: tri-, mono-, and oxychloride with adsorption temperatures on quartz of about 385, 475, and 655 K, respectively. All these compounds are easily washed away from the quartz equipment surface by 0.05 mol/l HCl solution.

11721 **(ORNL/TM—9820) ISPO Task A-126: application of mixed internal standards to the mass spectrometric analysis of plutonium and uranium in spent fuel dissolver solutions: ORNL results.** Smith, D.H.; Walker, R.L.; Carter, J.A. (Oak Ridge National Lab., TN (USA)). Nov 1985. Contract AC05-84OR21400. 82p. (ISPO—230). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86004657.

An experiment conducted jointly by the International Atomic Energy Agency, the COGEMA reprocessing facility at La-Hague, France, the French Center for Nuclear Studies at Saclay, and ORNL is nearing completion. The aim of this experiment is to evaluate the use of internal standards when applied under field conditions to spent fuel dissolver solutions. Samples were taken at La-Hague and shipped to Saclay, the IAEA in Vienna, and ORNL. Both resin beads and dried residues were shipped. ORNL has analyzed plutonium and uranium from these samples with good results: external precisions for uranium concentrations were +-0.06% and for plutonium +-0.2%. Copies of our report sheets are given in the appendices. 17 refs., 10 tabs.

11722 (SAND—85-0380, pp 189-200) **Chemistry of nuclear fuel (UO_2) dissolution under waste disposal vault conditions.** Shoesmith, D.W.; Bailey, M.G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Jul 1985. NTIS, PC A10/MF A01. File Number DE85016832. (CONF-8411160—).

From Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel; Albuquerque, NM, USA (13 Nov 1984).

The basic chemistry of UO_2 dissolution is considered under conditions typical of a nuclear fuel waste disposal vault, with particular emphasis on redox conditions and the effect of groundwater constituents, oxidizing agents and water radiolysis. The anodic

processes that occur during the oxidative dissolution of UO_2 have been established on the basis of electrochemical and x-ray photoelectron spectroscopic experiments. Using similar techniques, the kinetic effects of potential groundwater species, such as bicarbonate/carbonate, phosphate, and chloride, have been studied. The effect of potential oxidizing agents is not so well characterized. A number of interrelated reactions with UO_2, involving dissolved oxygen, hydrogen peroxide, and the products of water radiolysis, have been identified and discussed. The directions in which our studies are being extended are discussed.

11723 **(TRI-PP—82-31) Survey of the cleavage of aryl-metal bonds by elemental fluorine. Synthesis of aryl-fluorides.** Adam, M.J.; Pate, B.D.; Ruth, T.J.; Berry, J.M.; Hall, L.D. (TRIUMF, Vancouver, British Columbia (Canada)). Aug 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700468.

Also published in Can. J. Chem. v.61(4), p. 658-660 (1983).

The reaction of elemental fluorine with phenyl derivatives of tin, lead, germanium, silicon, mercury, and thallium has been studied with the aim of developing a general method for labelling aromatic compounds with radioactive ^{18}F. Rapid synthesis of fluorobenzene was achieved in varying chemical yields up to 70 percent, depending largely upon the metal substrate used, with aryl-tin compounds giving the highest yields. Radiochemical yields are also given for the synthesis of ^{18}F-fluoro-benzene from the cleavage of aryl-tin bonds with ^{18}F-F_2.

11724 **(TRI-PP—83-87) Fluorination of aromatic compounds with F_2 and acetyl hypofluorite. Synthesis of ^{18}F-aryl fluorides by cleavage of aryl-tin bonds.** Adam, M.J.; Ruth, T.J.; Jivan, S.; Pate, B.D. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1983. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700469.

Elemental fluorine and acetyl hypofluorite, labelled with ^{18}F, were added to eight simple aryl-tin derivatives. Both reagents gave good radiochemical yields of labelled aryl fluorides. Overall, acetyl hypofluorite gave more consistent yields (approximately 70 percent), while F_2 gave more variable yields (54 percent - > 95 percent).

11725 **Synthesis and characterization of crystalline phosphate of thorium, uranium and neptunium.** Bamberger, C.E.; Haire, R.G.; Begun, G.M.; Hellwege, H.E. (Oak Ridge National Lab., TN). *Journal of the Less-Common Metals;* **102**: 179-186(1984). Contract W-7405-ENG-26;AS05-76ER04447.

The high temperature synthesis and stability of phosphates of thorium, uranium and neptunium have been studied by Raman spectroscopy, X-ray diffraction and chemical analyses. For these actinides, the only orthophosphate $An_3(PO_4)_4$ (An identical to actinide) that could be prepared was thorium orthophosphate. The high temperature (α, cubic) forms of all three metal pyrophosphates were synthesized. For the oxypyrophosphate compounds $(AnO)_2P_2O_7$, only the thorium compound was not obtained, and $(NPO)_2P_2O_7$ is reported here for the first time. The results of these studies are discussed and compared with published data on actinide phosphates.

11726 **Half-life of ^{60}Fe.** Kutschera, W.; Billquist, P.J.; Frekers, D.; Henning, W.; Jensen, K.J.; Ma, X.; Pardo, R.; Paul, M.; Rehm, K.E.; Smither, R.K.; Yntema, J.L.; Mausner, L.F. (Argonne National Lab., IL). *Nuclear Instruments and Methods in Physics Research;* **B5**: 430-435(1984). Contract W-31-109-ENG-38.

The half-life of ^{60}Fe has been measured to be T/sub 1/2/ = (1.49 +/- 0.27) x 10^6 a, significantly longer than the one previous measurement of Roy and Kohman which reported a value of 3 x 10^5 a uncertain by a factor of 3. The present value was obtained from measurements of specific activity and radioisotope concentration in a material produced by spallation of copper with 191 MeV protons. $^{60}Fe/Fe$ ratios in the range of 10^{-8} were measured with the Argonne FN tandem-superconducting linear accelerator system in conjunction with an Enge split-pole spectrograph. The specific activity of ^{60}Fe in Fe was measured through the grow-in of the 1.332 MeV gamma-ray line of the ^{60}Co daughter activity.

11727 **Interaction of uranyl ions in carbonate media.** Morse, J.W.; Shanbhag, P.M.; Saito, A.; Choppin, G.R. (Texas A and M Univ., College Station). *Chemical Geology;* **42**: 85-99(1984).

The interaction of uranyl cation, in dilute solutions and seawater, with carbonate mineral solids was investigated in order to establish the relation between uranyl ion speciation and sorption. In solutions where the uranyl concentration approaches the carbonate alkalinity, rapid sorption followed by slow release occurs. This is accompanied by a color change in solution, spectroscopically determined to be the result of a change in the dominant uranyl species from hydroxy to carbonato complexes. In a heterogeneous system (solution and solid carbonate), the rate of reaction is directly dependent on the ratio of the surface area to the solution volume. The maximum extent of sorption is directly dependent on uranyl concentration and is almost independent of the surface area to volume ratio, the type of solution or the calcium carbonate mineral. Release of Ca, as a result of uranyl-carbonato complex formation, allows an estimation of the average uranyl to carbonate ratio of the complexes formed, which is in excellent agreement with predicted values.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 10897, 11710, 11781

11728 **(AD-A—158442/4/XAB) Preignition oxidation characteristics of hydrocarbon fuels. Final report, 15 April 1980-14 October 1984.** Cernansky, N.P.; Cohen, R.S.; Wilk, R.D. (Drexel Univ., Philadelphia, PA (USA). Dept. of Mechanical Engineering and Mechanics). Jul 1985. 120p. NTIS, PC A06/MF A01.

A research program to study the preignition oxidation characteristics of hydrocarbon fuels was carried out. A static reactor test facility and gas chromatographic analysis techniques were used to assess the preignition oxidation chemistry by determining the stable reaction intermediates and products formed during the preignition process. Comprehensive studies were made of the oxidation of propane and propene at low and intermediate temperatures (550-750 K) and at subatmospheric pressures. The experimental results for each of these fuels demonstrated a clear transition in the oxidation chemistry from a low-temperature regime to an intermediate-temperature regime, separated by a region of negative temperature coefficient. The main characteristics and features of the oxidation mechanisms were determined for each fuel in each temperature regime. Increasing the vessel surface-to-volume ratio had the effect of enhancing heterogeneous termination, but did not affect the main reaction paths of the mechanism. The experimental results for propene were used to modify and extend the high-temperature mechanism of Westbrook and Pitz to low and intermediate temperatures. Studies were also made of the preignition behavior of dodecane and binary mixtures of dodecane and the aromatic component tetraline. Addition to the tetralin of dodecane had the overall effect of decreasing the ignition tendency, although the magnitude of this effect was not proportional to the amount added.

11729 **(AD-A—158560/3/XAB) Multiple ignition, combustion, and quenching of hydrocarbon fuel sprays. Annual report, July 1983-July 1984.** Aggarwal, S.; Bishop, R.; Sirignano, W.A.; Sommer, H.T. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Mechanical Engineering). Aug 1984. 14p. NTIS, PC A02/MF A01.

A detailed parametric study of the ignition of a monodisperse fuel-air spray in contact with a hot wall was conducted. The theoretical model was one-dimensional unsteady and employed a hybrid Eulerian-Lagrangian numerical scheme. Effects of drop size, chemical kinetics, fuel-air ratios, fuel type, and other parameters were examined. The results indicated the statistical character of the spray ignition, the existence of optimum droplet size and optimum fuel-air ratio for the minimum ignition delays. The study was extended to the polydisperse spray. The major conclusion was that the polydisperse results can be correlated with an equivalent monodisperse spray represented by a mean diameter based on the total spray surface area. The study of ignition for sprays flowing over a

hot plate as initiated. The formulation and the numerical coding were completed. Currently, the code is being employed to predict the ignition delays for the flowing sprays. Preliminary experiments were conducted to investigate the ignition of a single droplet stream along a heated surface. The results show an optimal distance from the surface for the droplet stream. It is speculated that this distance depends on the characteristic evaporation time, diffusion time, and convective time inherent to the system. Experiments separating the effects are underway to investigate this interactive process.

11730 **(AD-A—158692/4/XAB) Fuels combustion research. annual report, March 1, 1982-February 28, 1983.** Dryer, F.L.; Glassman, I.; Williams, F.A. (Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering). 22 Nov 1983. 144p. (MAE—1640). NTIS, PC A07/MF A01.

A qualitative mechanism of aromatic oxidation was developed and is of significant importance for the understanding of soot processes and combustor modeling. Kinetic results on toluene and ethyl benzene elucidated how aromatic side chains are oxidized and contribute further towards developing overall mechanisms for combustor modellers. Extensive results on fuel-pyrolysis rates were obtained. These results reveal that pyrolysis rates alone do not control sooting intensity, but also the pyrolysis reveal that pyrolysis rates alone do not control sooting intensity, but also the pyrolysis intermediates formed. A complete phenomenological model of soot formation was developed and refined by comparison with the experimental results. This model permitted the identification of the phenomena controlling soot formation in both premixed and diffusion-flame combustion systems and has great immediate practical applications. In particular, lengthy experimentation has shown that the combustion temperature is one of the most-significant parameters in determining sooting tendencies in both diffusion and premixed flame situations with temperature as a controlled parameter the real effect fo fuel type can be determined. A reliable generator of well-characterized suspensions of boron slurries was designed and constructed. Two significant new findings with respect to the ignition combustion of boron particles are reported. The theoretical work on turbulent combustion has treated both premixed and diffusion flames by asymptotic methods.

11731 **(AD-A—158824/3/XAB) Measurement of rate constants of elementary gas reactions of importance to upper atmosphere and combustion systems. Final technical report, 1 September 1980-28 February 1985.** Kaufman, F. (Pittsburgh Univ., PA (USA). Dept. of Chemistry). 10 May 1985. 11p. NTIS, PC A02/MF A01.

The vibrational energy transfer of highly excited HCl and HF was studied by the infrared chemiluminescence method in a series of five papers. HCl(v < or = 7) and HF(v < or = 7) were produced by fast generating reations, e.g., H + IC1 yields (v < or = 7) + I or H +F2 yields (< or = 7) + F in large excess He which relaxes the rotational but not the vibrational excitation. With various added quencher gases, about 200 rate constants for stepwise vibrational energy transfer were measured. They tend to increase rapidly with increasing v, often independent of the vibrational energy defect. For HF (v) + HF (O), self-relaxation, the V-V channel decreases from 55% at v=2 to zero at v > 5 even though the relaxation rate constant rises as v to the 2.7 power. A versatile flow reactor system was built that features three detection methods (laser-induced fluorescence, vacuum u.v. resonance fluorescence, and modulated molecular beam mass spectrometry) plus upstream radical production by IR laser multiphoton decomposition. The NH_2 + NO and CH_3O + NO_2 reactions were studied successfully. The latter was found to have a recombination (CH_3ONO_2) and disproportionation (CH_2O + HNO_2) channel and both were measured indirectly. The ^{18}O + NO or O_2 isotope exchange reactions were measured, and the results compared with measured and calculated high-pressure limits of the respective recombinations and with NO vibrational relaxation.

11732 **(AD-A—158931/6/XAB) Droplet size and evaporation rate within a two-phase flow by morphology-dependent resonances in the optical spectra. Final report, 15 November 1981-31 December 1984.** Chang, R.K.; Chu, B.T.; Long, M.B. (Yale Univ., New Haven, CT (USA)). 10 Apr 1985. 28p. NTIS, PC A03/MF A01.

In two-phase chemically reacting flows, the size, shape, and chemical content of fuel droplets affect combustion and their chemical by-products. A new in-situ and nonintrusive optical technique was developed that provides highly accurate (one part in 10000 - 100,000) size and shape determination, as well as chemical speciation of the majority species forming the droplet. This all-optical technique uses the morphology-dependent resonances (MDRs) of spheres, spheroids, or any shape that enables an internal wave to travel around a great circle with appropriate phase shift. These MDRs in the fluorescence spectra of dye-doped droplets flowing in a linear stream have also provided information on: (1) evaporation rate of interacting droplets flowing in the ambient or heated environment; (2) condensation rate of interacting droplets flowing in a saturated vapor; and (3) surface tension and bulk viscosity of individual droplets that have been perturbed by a laser beam so as to cause slight shape distortions, e.g., from spheres to oblate or prolate spheroids. MDRs can provide wavelength-selective high-Q optical feedback for the internally generated fluorescent and Raman radiation. By using this high optical feedback, lasing from individual dye-tagged droplets of approx. 20-micron radius was achieved. The potential of using bright lasing droplets as markers in flow diagnostics is promising. Stimulated Raman scattering from individual droplets of approx. 20 micron radius has been achieved.

11733 **(AD-P—004920/5/XAB) Shock-induced thermal runaway.** Jackson, T.L.; Kapila, A.K. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Mathematical Sciences). Feb 1985. 12p. NTIS, PC A02/MF A01.

Ignition of an initially cold combustible gas is studied when a chemical reaction is switched on due to the passage of a piston-supported shock of sufficient strength. The time and space history of the shocked gas up to the instant of thermal runaway is described, by using a combination of asymptotics and numerics. Consider a combustible material confined to the half space $x > 0$ and capable of undergoing an exothermic chemical reaction of the Arrhenius type. Suppose that the temperature of the material is so low that it is practically inert, and will not burn if left alone. Let combustion be initiated by applying an ignition stimulus at the boundary $x = 0$. It is of considerable interest to obtain a mathematical description of the events following the application of the stimulus. In particular, if a combustion wave propagating through the material is eventually established, it is important to understand the evolutionary process that gives rise to it.

11734 **(DOE/PC/60802—T5) Aerosol formation from pulverized coal combustion. Quarterly report No. 9.** Linak, W.P.; Peterson, T.W. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). 1 Dec 1985. Contract FG22-83PC60802. 46p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004515.

Fly ash produced by combustion of six coals or Israel shale oil was characterized with respect to elemental composition, and particle size distribution. 13 refs., 4 figs., 38 tabs. (DT)

11735 (IAEA-TC—427/6, pp 10-14) **Concentration limits of hydrogen ignition in air in mixtures with non-combustible gases under normal circumstances.** Ivanov, A.V.; Korol'chenko, A.Ya.; Shebeko, Yu.N. (All-Union Fire Fighting Scientific Research Inst., Moscow (USSR)). Sep 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE86780327. (CONF-8309265—; TC-SR—2).

From IAEA specialists meeting on hydrogen behaviour and control and related containment loading aspects; Suzdal, USSR (19 Sep 1983).

Translated from Russian.

The paper describes an experimental investigation of concentration limits at which hydrogen and various diluents (nitrogen, carbon dioxide, helium, argon, chloropentafluoroethane, 1,2 - dibromtetrafluorethane) ignite in oxynitrogen oxidizing media. It is

shown that the fuel and desensitizer concentrations can be calculated at desensitization points for chemically inert diluents.

11736 (IAEA-TC—427/6, pp 14-32) **Detonation characteristics of hydrogenous mixtures.** Borisov, A.A.; Gel'fand, B.E.; Tsyganov, S.A. (AN SSSR, Moscow. Inst. Khimicheskoj Fiziki). Sep 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE86780327. (CONF-8309265—; TC-SR—2).

From IAEA specialists meeting on hydrogen behaviour and control and related containment loading aspects; Suzdal, USSR (19 Sep 1983).

Translated from Russian.

The paper reviews and summarizes the results contained in 48 referenced publications related to the subject and evaluates their significance for nuclear power plant safety. The main sections of the paper deal with: parameters of the combustion and detonation process in hydrogeneous mixtures; critical conditions for activation of combustion and detonation in hydrogeneous mixtures; and parameters of pressure waves during explosions of hydrogeneous mixtures. The text is supplemented by 6 tables and 32 figures.

11737 (IAEA-TC—427/6, pp 33-37) **Theoretical evaluation of critical gas layer thickness in relation to detonation wave propagation.** Shebeko, Yu.N.; Korol'chenko, A.Ya. (All-Union Fire Fighting Scientific Research Inst., Moscow (USSR)). Sep 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE86780327. (CONF-8309265—; TC-SR—2).

From IAEA specialists meeting on hydrogen behaviour and control and related containment loading aspects; Suzdal, USSR (19 Sep 1983).

Translated from Russian.

The study of detonation wave propagation in gas volumes of finite thickness is important for safeguarding various technological processes from explosions. Available literature includes theoretical calculation of critical gas layer thickness in relation to steady-state propagation of the deformation wave, and studies in detail gas-dynamic processes and reveals the pulsating nature of the detonation wave, but gives only a very rough description of the chemical kinetic processes. This paper aims to evaluate the critical gas layer thickness with a more realistic description of heat release processes resulting from the chemical reaction. A numerical simulation of two-dimensional detonation wave propagation is given in a gaseous layer of finite thickness for oxyhydrogen and for a stoichiometric hydrogen-air mixture.

11738 (IAEA-TC—427/6, pp 37-41) **Determination of flame propagation limits in stoichiometric oxyhydrogen mixtures with steam.** Kogarko, S.M.; Lyamin, A.G.; Popov, O.E.; Kusharin, A.Yu. (AN SSSR, Moscow. Inst. Khimicheskoj Fiziki); Dubrovin, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Sep 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE86780327. (CONF-8309265—; TC-SR—2).

From IAEA specialists meeting on hydrogen behaviour and control and related containment loading aspects; Suzdal, USSR (19 Sep 1983).

Translated from Russian.

Experiments are described and results presented on combustion processes of mixtures of hydrogen, oxygen and steam under pressures up to 16 atm and temperatures up to 250 deg. C. The effects of temperature (at constant pressure) and of pressure (at constant temperature) on concentration limits are shown.

11739 (IAEA-TC—427/6, pp 90-98) **Basis for safety standards aimed at averting fire and explosion hazards during work involving hydrogen.** Baratov, A.N. (All-Union Fire Fighting Scientific Research Inst., Moscow (USSR)). Sep 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE86780327. (CONF-8309265—; TC-SR—2).

From IAEA specialists meeting on hydrogen behaviour and control and related containment loading aspects; Suzdal, USSR (19 Sep 1983).

Translated from Russian.

Safety standards for averting fire and explosion hazards due to hydrogen require a sound knowledge of hydrogen properties at various conditions. Relevant research work is referred to, relating to prevention of combustible mixtures, the effects of homogeneous and heterogeneous combustion inhibitors and of inert diluents, the influence of obstacles on flame propagation velocity, and the mitigation of consequences should combustion occur.

11740 (NUREG/CR—4136) **SMOKE: a data reduction package for analysis of combustion experiments.** Ratzel, A.C.; Kempka, S.N.; Shepherd, J.E.; Reed, A.W. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1985. Contract AC04-76DP00789. 128p. (SAND—83-2657). NTIS, PC E07/MF A01 - GPO. File Number TI86003524.

Includes 6 sheets of 48x reduction microfiche.

A suite of computer codes, collectively referred to as SMOKE, has been developed to expedite the processing and analysis of data obtained from transient combustion tests. Instrumentation signals which can be processed using SMOKE include pressure sensors, gas and wall thermocouples, and different types of calorimetry such as Sandia-developed thin-film gauges, capacitance-type slug calorimeters, and commercial Gardon-type heat flux gauges. This package has been used to analyze data from combustion experiments conducted at the Sandia National Laboratories FITS facility and in the hydrogen dewar at the Nevada Test Site. In this report, we discuss the theory and models used in the computer codes comprising SMOKE. Details of the data files, signal preparation, and processing procedures for executing SMOKE are provided. Sample data files and representative results using SMOKE are included.

42 ENGINEERING

11741 (SAND—85-0813) **Experimental study of the performance of clustered parachutes in a low-speed wind tunnel.** Baca, B.K. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1985. Contract AC04-76DP00789. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004977.

Recent interest in clusters of parachutes prompted a review of cluster drag data and inflation characteristics. This examination indicated that very little well-documented data exist that are suitable for broad applications. A low-speed wind-tunnel test program was devised to measure the effects of variations in four important parameters on the terminal drag and stability of clusters of parachutes. The parameters studied were canopy number, canopy type, riser length, and reefing. Efforts were made to account for effects stemming from the experiment's design, especially wind-tunnel blockage. Many of the results of the wind-tunnel tests were validated by a series of drop tests. Terminal drag and stability data are presented here along with proposed explanations for observed phenomena.

4201 General Engineering

11742 (SAND—84-2598) **Combined experimental/analytical modeling of shell/payload structures.** Martinez, D.R.; Miller, A.K.; Carne, T.G. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1985. Contract AC04-76DP00789. 47p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004968.

This study evaluates the accuracy of computed modal frequencies obtained from a combined experimental/analytical model of a shell/payload structure. A component mode synthesis technique was used which incorporated free modes and residual effects. The total structure is physically divided into the two subsystems which are connected through stiff joints. The payload was tested to obtain its free-free modes, while a finite element model of the shell was analyzed to obtain its modal description. Both the translational and rotational components of the experimental mode shapes at the payload interface were used in the coupling. Sensitivity studies were also performed to determine the effect of neglecting the residual terms of the payload. Results from a previous study of a combined experimental/analytical model for a beam structure are also given. The beam structure was used to examine the basic procedures and difficulties in experimentally measuring, and analytically accounting for the rotational and residual quantities.

11743 (SAND—85-2121C) Exact integration algorithm for use with modal analysis. Rodeman, R. (Sandia National Labs., Albuquerque, NM (USA)). [1985]. Contract AC04-76DP00789. 6p. (CONF-860224—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85018533.

From 4. international modal analysis conference; Los Angeles, CA, USA (3 Feb 1986).

A modal analysis integration algorithm which is exact for a piecewise-linear excitation has been developed. Since virtually all field excitations are represented in digitized form, a piecewise-linear representation is appropriate. The integration algorithm is obtained by constructing a recursive, ramp-invariant digital filter. The recursive form is simple; only five additions and five multiplications are necessary to determine a new response point. This algorithm is compared with the Newmark-beta, central difference, trapezoidal rule, and linear-acceleration algorithms. It is shown that the new algorithm has a marked superiority. It is also shown that the classical algorithms can produce poor results, even when the algorithms are unconditionally stable.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 11227, 11227, 11466, 11515, 11809, 12483

11744 (CONF-8111235—1) Elasto-plastic creep analysis of an exisymmetric shell subject to pure thermal loading. Lee, D.J.; Newton, P.; Proffitt, D. (National Nuclear Corp. Ltd., Knutsford (UK); SIA Ltd., London (UK)). 1981. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86900360.

From European conference on non-linear finite element analysis; Hague, Netherlands (25 Nov 1981).

An axisymmetric thin shell component has been analyzed subject to cyclic thermal loading conditions. The initial loading has been applied as steady state conditions at high temperature and results in a locally yielded region of the shell in which a small degree of strain enhancement is exhibited. These conditions have been held for several hundred hours during which the creep response in the locally yielded region shows considerable stress relaxation which is accompanied by a significant forward creep strain. The unloading portion of the cycle has been considered as a transient response during which some of the shell are subject to temperature gradient reversals which result in an enhanced strain range. It has been shown that on reapplication of the initial steady state conditions the stress/strain state at the point of interest returns after creep relaxation to the same as that for the first cycle. These results demonstrate that, although there is considerable elastic follow-up in local regions of the shell during creep stress redistribution, the phenomenon is self limiting and a steady state cyclic response is quickly attained.

11745 (JINR—8-84-248) Some problems of emergency protection of helium cryostats. Bartenev, V.D.; Volkov, V.Ya.; Datskov, V.I.; Zel'dovich, A.G.; Shishov, Yu.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700367.

Submitted to the 7. National conference on low temperature techniques "Kriogenics- 84", Bratislava, Czechoslovakia, 1984.

Some processes in helium cryostats at emergency spoiling of insulation vacuum are considered. Safety system of a long helium cryostat, a totally opened valve and plug with break-away bolts, are described. Recommendations as to the protection of helium cryostats are developed.

11746 (K—2057) Renovation of DOT specification 21PF-1 protective shipping packages. Barlow, C.R.; Ziehlke, K.T.; Pryor, W.A.; Housholder, W.R. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 20 Dec 1985. Contract AC05-84OT21400. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005109.

Protective shipping packages for isotopically enriched uranium hexafluoride show deterioration with extended service, principally, structural damage from rough handling, and rust damage from exposure to weather and from storage practices which may promote absorption of water by the insulating foam. This report summarizes and/or references work which has been done to evaluate the integrity of the phenolic foam insulation in used shipping packages and outlines the process developed for drying the foam prior to rework of the containers. Mechanical and thermal properties of the foam are not adversely affected by the presence of limited amounts of water, nor are they degraded by the removal process. Rework of the packages, however, must be preceded by moisture removal to slow or avoid continuing rust damage, and tests have shown that drying can be effected by heating at 190°F and above for periods of three days or more. Drying progress is monitored by weight loss and/or by use of a moisture meter.

11747 (ORNL/M—85) Process and equipment capabilities, Materials Joining Laboratory, 1985. Reed, R.W. Jr.; David, S.A. (Oak Ridge National Lab., TN (USA)). Sep 1985. Contract AC05-84OR21400. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004831.

11748 (SAND—85-2060C) Rectangular plate is proposed as an IES modal test structure. Smallwood, D.O.; Gregory, D.L. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 10p. (CONF-860224—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85018274.

From 4. international modal analysis conference; Los Angeles, CA, USA (3 Feb 1986).

Numerous modal systems are now marketed by commercial companies and new users are continually being introduced to these systems. A simple test structure would be useful to compare these systems on a common basis. The structure would also provide new users with a means to evaluate their newly acquired experimental and analytical skills. This paper will discuss a particular proposed rectangular plate. The physical description of the plate is given, the modal properties of the plate are discussed, and experimental results are given to illustrate the plate behavior.

11749 (UCID—20592) Stress analysis of the ROQUEFORT diagnostic canister by finite-element method. Shukla, S.N.; Pratuch, S.M. (Lawrence Livermore National Lab., CA (USA)). 7 Nov 1985. Contract W-7405-ENG-48. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004902.

The ROQUEFORT diagnostic canister was modelled by computer and subjected to three load cases. Results of both the computed and measured deflections are presented. (BCS)

11750 Signal and noise theory for a dc SQUID amplifier. Martinis, J.M.; Clarke, J. (Department of Physics, University of California, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California). *Journal of Low Temperature Physics;* **61**: No. 3, 227-236(1 Nov 1985). Contract AC03-76SF00098.

A theory is presented for the gain and noise in an amplifier based on a dc SQUID. In the lumped circuit approximation, the total inductance of the input circuit L/sub T/ is coupled to the SQUID inductance L via a mutual inductance M/sub i/ = α/sub e/(LL/sub T/)/sup 1/2/ and is in series with a voltage source with a resistance R/sub i/ and a capicitance C/sub i/. The results are expressed in terms of parameters for a SQUID with reduced inductance (1-α/sub e/^{2})L. The voltage gain of the amplifier at frequency $\omega/2\pi$ is M/sub i/V/sub phi//sup r//Z/sub T/((ω), while the total voltage noise at the output of the SQUID is V/sub N//sup r/(ω)+M/sub i/^{2} V/sub phi//sup r/J/sub N//sup r/(ω)(R/sub i/+1/jωC/sub i/)/L/sub T/Z/sub T/((ω). Here, Z/sub T/((ω) = Z/sub T/(ω)-J/sub Phi//sup r/M/sub i/^{2}(R/sub i/+ 1/jωC/sub i/)/L/sub T/, where Z/sub T/(ω) is the total impedance of the unloaded input circuit, V/sub Phi//sup r/ and J/sub Phi//sup r/ are the flux-to-voltage and flux-to-circulating current transfer functions of the reduced SQUID, and V/sub N//sup r/(ω) and J/sub N//sup r/(ω) are the noise voltage and noise current of the reduced SQUID.

11751 **Measurements of the dynamic input impedance of a dc SQUID.** Hilbert, C.; Clarke, J. (Department of Physics, University of California, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California). *Journal of Low Temperature Physics;* **61**: No. 3, 237-262(1 Nov 1985). Contract AC03-76SF00098.

The impedance of a circuit coupled magnetically via a mutual inductance M/sub i/ to a dc SQUID of geometric inductance L is modified by the dynamic input impedance of the SQUID, which can be characterized by the flux-to-current transfer function J/sub Phi/≠partialJ/partialPhi; J is the current circulating in the SQUID loop and ∫ is the flux applied to the loop. At the same time, the SQUID is modified by the presence of the input circuit in the lumped circuit approximation, one expects its inductance to be reduced to L'(1-α/sub e/²)L, where α/sub e/ is an effective coupling coefficient. Calculations of J/sub Phi/ using an analog simulator are described and presented in the form of a dynamic inductance L and a dynamic resistance R versus bias current I and Phi. Experimental measurements of L and R were made on a planar, thin-film SQUID tightly coupled to a spiral input coil that was connected in series with a capacitor C/sub i/ to form a resonant circuit. Thus, J/sub Phi/ was determined from the change in the resonant frequency and quality factor of this circuit as a function of I and Phi. At low bias currents (low Josephson frequencies) the measured values of L were in reasonable agreement with values simulated for the reduced SQUID, while at higher bias currents (higher Josephson frequencies) the measured values were in better agreement with values simulated for the unscreened SQUID. Similar conclusions were reached in the comparison of the experimental and simulated values of the flux-to-voltage transfer function V/sub Phi/.

11752 **dc SQUIDs as radiofrequency amplifiers.** Hilbert, C.; Clarke, J. (Department of Physics, University of California, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California). *Journal of Low Temperature Physics;* **61**: No. 3, 263-287(1 Nov 1985). Contract AC03-76SF00098.

The optimization of radiofrequency amplifiers involving dc SQUIDs is discussed for both tuned and untuned input circuits. For a given frequency and input coil coupled to the SQUID, expressions are obtained for the optimum source resistance, gain, and noise temperature. The performance of two amplifiers designed according to these predictions is described. The gain of an untuned amplifier operated at 100 MHz and 4.2 K was 16.5 +- 0.5 dB with a noise temperature of 3.8 +- 0.9 K; at 1.5 K the gain increased to 19.5 +- 0.5 dB, while the noise temperature decreased to 0.9 +- 0.4 K. A tuned amplifier operated at 93 MHz and 4.2 K had a gain of 18.6 +- 0.5 dB and a noise temperatue of 1.7 +- 0.5 K. These results were in good agreement with predicted values.

11753 **Finite deformation of viscoelastic rotating disks.** Feng, W.W. (Lawrence Livermore National Lab., CA). *International Journal of Non-Linear Mechanics;* **20**: No. 1, 21-26(1985). Contract W-7405-ENG-48.

The governing equations for a rotating disk under large elastic or viscoelastic deformations are formulated in terms of two coupled first-order ordinary differential-integral equations with explicit derivatives. The constitutive equations developed by Christensen are used for the formulation. A recurrent formula for the hereditary integrals is obtained. This recurrent formula makes it possible for the same governing equations and numerical methods to be applied to both elastic and viscoelastic problems.

11754 **Laser-illuminated nano-second microscope.** Frank, A.M.; Hein, D.F. (Lawrence Livermore National Lab., CA). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **491**: 661-668(1984). Contract W-7405-ENG-48.

In high magnification systems, laser speckle limits the resolution of laser illuminated targets. The authors developed a broad bandwidth laser illuminator that substantially reduces the speckle. This laser has been incorporated with intensified camera technology and suitable lensing to provide a microscope system with good resolution over a 75 mm diameter image. The microscope currently has a 2-ns exposure onto film with magnification adjustable between 5X and 50X. 6 references, 10 figures.

4203 Lasers

REFER ALSO TO CITATION(S) 11754, 12487, 12505

11755 **(CONF-850956—Absts.) 7th international free electron laser conference. Abstracts.** (Lawrence Livermore National Lab., CA (USA)). 1985. Contract W-7405-ENG-48. 198p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86003485.

From 7. international free-electron laser conference; Tahoe City, CA, USA (8 Sep 1985).

A collection of the abstracts of papers presented at the seventh international free electron laser conference is presented. Topics covered include: oscillator experiment and theory; wiggler and accelerator technology; high-gain free electron lasers; harmonic generation; experiments; unconventional free electron laser schemes; space-charge and guide field effects; optical guiding and other theoretical topics. (BCS)

11756 **(DOE/DP/40124—75) Holographic wavefront characterization of a frequency-tripled high-peak-power neodymium:glass laser.** Kessler, T.J. (Rochester Univ., NY (USA)). 1984. Contract AC08-80DP40124. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86004198.

Near-field amplitude and phase distributions from a high-peak-power, frequency converted Nd:glass laser (λ = 351 nm) have been holographically recorded on silver-halide emulsions. Conventionally, the absence of a suitable reference beam forces one to use some type of shearing interferometry to obtain phasefront information, while the near-field and far-field distributions are recorded as intensity profiles. In this study, a spatially filtered, locally generated reference beam was created to holographically store the complex amplitude distribution of the pulsed laser beam, while reconstruction of the original wavefront was achieved with a continuous-wave laser. Reconstructed near-field and quasi-far-field intensity distributions closely resembled those obtained from conventional techniques, and accurate phasefront reconstruction was achieved. Furthermore, several two-beam interferometric techniques, not practicable with a high-peak-power laser, have been successfully implemented on a continuous-wave reconstruction of the pulsed laser beam. 46 refs., 40 figs., 1 tab.

11757 **(DOE/DP/40203—1) Research in gadolinium scandium gallium garnet (GSGG) crystal development. Final report, 1 May-31 December 1984.** (Allied Corp., Charlotte, NC (USA). Synthetic Crystal Products Group). Jul 1985. Contract AC08-84DP40203. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004292.

The Czochralski growth technique was utilized for the development of a large diameter, laser quality gadolinium, scandium gallium garnet co-doped with neodymium and chromium (Nd:Cr:GSGG). Vary aspects of the development were determinations of raw material purity, foule growth runs, boule composition and lattice parameters, and losses. 8 refs., 13 figs., 10 tabs. (WRF)

11758 **(UCRL—52000-85-11) Energy and Technology Review.** (Lawrence Livermore National Lab., CA (USA)). Nov 1985. Contract W-7405-ENG-48. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005295.

This issue is devoted entirely to x-ray laser technology. It includes information on theory, LASNEX and XRASER modeling codes, experiments, the Novette laser system, x-ray lasing targets, time-resolving x-ray spectrometers capable of subnanosecond resolution for diagnostics, and future directions in x-ray laser physics. (GHT)

11759 **Kinetic description of harmonic instabilities in a planar wiggler free-electron laser.** Davidson, R.C. (Science Applications International Corporation, Boulder, Colorado 80302). *Physics of Fluids;* **29**: No. 1, 267-274(Jan 1986).

The linearized Vlasov—Maxwell equations are used to investigate harmonic stability properties for a planar wiggler free-electron laser (FEL). The analysis is carried out in the Compton regime for a tenuous electron beam propagating in the z direction

through the constant-amplitude planar wiggler magnetic field B^0 = -B/sub w/ cos $k_o$ze/sub x/. Transverse spatial variations are neglected (partial/partialx = 0 = partial/partialy), and the case of an FEL oscillator (temporal growth) is considered. Assuming ultrarelativistic electrons and κ^2 = a^2/sub w//(γ^2_o-1) <<1, where a^2/sub w/ = e^2B^2/sub w/ /$m^2c^4k^2_o$ and $\gamma_o mc^2$ is the electron energy, the kinetic dispersion relation is derived in the diagonal approximation for perturbations about general beam equilibrium distribution function $G^+{}_o(\gamma_o)$. Because of the wiggler modulation of the axial electron orbits, strong wave—particle interaction can occur for ωroughly-equal[k+k_o(1+2l)] β/sub F/c, where β/sub F/c is the axial velocity, ω and k are the wave oscillation frequency and wavenumber, respectively, and l = 0, 1, 2, . . . are harmonic numbers corresponding to an upshift in frequency.

11760 **Spectroscopy of Ldagger-series transitions for x-ray laser photopumping.** Burkhalter, P.G.; Newman, D.A.; Hailey, C.J.; Rockett, P.D.; Charatis, G.; MacGowan, B.J.; Matthews, D.L. (Naval Research Laboratory, Washington, DC 20375). *Journal of the Optical Society of America B: Optical Physics;* 2: No. 6, 1894-1905(Dec 1985). Contract AC08-82DP40152.

Candidate photopumping materials for resonant photoexcitations x-ray laser schemes were examined to determine spectral line position and radiant line intensity. Improved spectroscopic techniques have permitted several comparative measurements to be made with greater sensitivity and resolution thn that of earlier work. A cylindrically focused 0.527-μm laser beam was used to generate the plasma source emission by irradiating thin foil targets. Selected wavelength regions in the 10—17-A range were studied for possible line coincidence between K-series transitions in F, Ne, and O with emission from transition-metal targets. Within the measurement accuracy of +-2 mA, exact spectral line coincidences were found for Mn with the F H-β line at 12.643 A and for both Mn and Cr with the F He-β line at 14.458 A. The Mn line at 12.643 at 12.643 has been identified, using ab initio atomic-structure calculations, as the $^1D_2$-$^1F_3$ transitions in Be-like Mn XXII. This line was found to yield 2—5 mJ into 2π sr with 20 J of laser energy on target. Spectral identifications and wavelengths for Be-like Ti, Cr, Mn, Fe, and Co lines, for Li-like Ti, Cr, and Mn lines, and for N-like Mn lines also resulted from this work.

11761 **An active mode-locked Q-switched oscillator using Nd^{3+} doped glass as the active medium.** Albrecht, G.F.; Gruneisen, M.T.; Smith, D. (Laboratory for Laser Energetics, University of Rochester, Rochester, NY). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* GE-21: No. 8, 1189-1194(Aug 1985).

-Based on the understanding of mode-locking dynamics in homogeneously broadened media, active mode-locked Q-switched YAG and YLF oscillators have emerged as the preferred source of highly controllable, reproducible, and synchronizable mode-locked pulses. This paper describes the modification of such a system for use with glass as the active medium. The emphasis is on measurements determining the mode-locking behavior of this laser.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 10912, 10956, 10957, 11732

11762 **(AD-A—158094/3/XAB) Analysis of the effects of transient heat transfer on axial-flow-compressor-blade boundary layers. Master's thesis.** Wood, C.W. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). Jun 1985. 69p. (AFIT-CI—NR-85-87T). NTIS, PC A04/MF A01.

The magnitude of heat transfer in the high-pressure compressor of a turbofan engine during a Bodie throttle transient is determined, and the effect of transient heat transfer on compressor blade boundary layer growth is estimated. Total stored thermal energy available for release is determined considering compressor blades and roots only. Thermal energy released during a throttle transient is determined and allocated to individual compressor stages and used to estimate blade heat flux. The average heat transfer coefficient at the maximum heat transfer rate is also calculated. A simple boundary layer analysis is performed, assuming zero-pressure-gradient, compressible turbulent flow over a flat plate. Under free-stream conditions similar to those in the tenth stage of the compressor, this analysis shows increased boundary layer displacement thickness with heat transfer. In zero-pressure gradient, the displacement thickness change with heat transfer is small, as is the change in flow deviation angle at the trailing edge of the compressor blade. Heat-transfer coefficients are also calculated in the boundary-layer analysis and agree with results from the experimental heat-transfer allocation procedure to within 30%. Results of boundary-layer analysis indicate assumptions made in heat-transfer allocation procedure are reasonable and that simple boundary layer analysis with the absence of modifying pressure gradients provides a good first estimate of heat-transfer effects on blade boundary layers.

11763 **(CONF-851174—24) Prediction of flow rates through an orifice at pressures corresponding to the transition between molecular and isentropic flow.** DeMuth, S.F.; Watson, J.S. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Chemical Engineering). 1985. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004682.

From 32. national vacuum symposium and topical conference; Houston, TX, USA (19 Nov 1985).

A model of compressible flow through an orifice, in the region of transition from free molecular to isentropic expansion flow, has been developed and tested for accuracy. The transitional or slip regime is defined as the conditions where molecular interactions are too many for free molecular flow modeling, yet not great enough for isentropic expansion flow modeling. Due to a lack of literature establishing a well-accepted model for predicting transitional flow, it was felt such work would be beneficial. The model is nonlinear and cannot be satisfactorily linearized for a linear regression analysis. Consequently, a computer routine was developed which minimized the sum of the squares of the residual flow for the nonlinear model. The results indicate an average accuracy within 15% of the measured flow throughout the range of test conditions. Furthermore, the results of the regression analysis indicate that the transitional regime lies between Knudsen numbers of approximately 2 and 45. 4 refs., 3 figs., 1 tab.

11764 **(UCID—20297-85-4) Lawrence Livermore National Laboratory Granular Flow Project. Quarterly report, October-December 1985.** Walton, O.R. (ed.). (Lawrence Livermore National Lab., CA (USA)). 30 Dec 1985. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005088.

LLNL's Granular Flow Project is developing and utilizing new discrete particle computer models to determine the rheologic characteristics of idealized granular solids under various flow conditions. During FY 1985 two-dimensional granular material models of assemblies of inelastic, frictional, circular disks were developed and utilized in various parameter studies. During the current reporting period we completed an initial parameter study of steady shearing flows of idealized granular materials consisting of assemblies of equal-sized, inelastic spheres. The results of this study have been submitted for publication in Acta Mechanica. Our three-dimensional computer model has also been extended to include frictional interactions between spherical particles. A calculational series is underway examining the effects of interparticulate friction and rotations on the stresses in steady shearing flows. New post processing routines have also been written that provide the capability of making multi-color three-dimensional perspective-projection motion pictures of the granular flow calculations. We report below the highlights of the work performed during this first quarter of FY 1986. 7 refs., 3 figs.

11765 **Formulation of hyperbolic Stefan problems.** Solomon, A.D.; Alexiades, V.; Wilson, D.G.; Drake, J. (Oak Ridge National Laboratory). *Quarterly of Applied Mathematics;* 43: No. 3, 295-385(Oct 1985). Contract AC05-84OR21400.

The study of phase change processes governed by hyperbolic heat transfer is at an embryonic stage. We raise here some of the relevant questions and make some remarks on the formulation and qualitative behavior of hyperbolic Stefan problems. In particular, we correct an error in the interface condition appearing in two ear-

lier studies, and present an explicit solution to a simple one-phase problem and study its behavior. Finally we describe an enthalpy (weak) formulation for a two-phase problem and report on a few numerical experiments based on it.

11766 **Method and apparatus for measuring shear modulus and viscosity of a monomolecular film.** Abraham, B. M.; Ketterson, J. B.; Miyano, K. (to The United States of America as represented by the United States Department of Energy, Washington, DC). US Patent 4,537,064. 27 Aug 1985. Filed date 18 Oct 1983. vp.

PAT-APPL-542957.

Instrument for measuring the shear modulus of a monomolecular film comprises a circular trough having inwardly sloping sides containing a liquid for supporting the monolayer on the surface thereof; a circular rotor suspended above the trough such that the lower surface of the rotor contacts the surface of the liquid, positioned such that the axis of the rotor is concentric with the axis of the trough and freely rotable about its axis; apparatus for hydrostatically compressing the monolayer in the annular region formed between the rotor and the sides of the trough; and apparatus for rotating the trough about its axis. Preferably, hydrostatic compression of the monolayer is achieved by removing liquid from the bottom of the trough (decreasing the surface area) while raising the trough vertically along its axis to maintain the monolayer at a constant elevation (and maintain rotor contact). In order to measure viscosity, a apparatus for rotating the rotor about its axis is added to the apparatus.

11767 **(LA-tr—86-1) Calculation of sliding interfaces of two-dimensional unsteady flow.** Kao-yu, H.; Kuang-i, C. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. Translated from Pao-cha yu ch'ung-chi; 3: No. 10, 10-18(1983) . 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005003.

A new technique is described for the numerical investigation of time-dependent elastic-plastic flow with sliding interfaces. The Lagrangian equations of sliding motion are derived analytically; detailed results for sliding interfaces are described. Numerical simulation results of a standard cylinder test are in good agreement with experimental data. In the problem of two-dimensional unsteady flow, sliding (contact interruption) is a kind of mechanical phenomenon frequently occurred. On a sliding plane, the normal-direction velocity of the sliding object is continuous while the tangential-direction velocity is interrupted. The differential equation for motion does not apply, therefore another group of sliding-motion equations should be used instead. In the paper, the following conditions are assumed: elastic-plastic flow, and frictionless (nonviscous) sliding plane. An analysis method is used to derive the sliding motion equations. In addition, a type of difference model is presented for the sliding motion equations. Finally, an example is given for numerical calculation. 4 refs., 6 figs.

4205 Materials Testing

11768 **(DOE/ER/45057—1) Investigations of ultrasonic wave interactions at boundaries separating anisotropic materials. Progress report.** Adler, L. (Ohio State Univ., Columbus (USA). Dept. of Welding Engineering). Nov 1985. Contract FG02-84ER45057. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004953.

The studies of the interaction of waves with interfaces between generally anisotropic media were supported experimentally. Two boundary condition on the interface were considered: rigid, and slip. The latter boundary condition describes dislocation boundaries and slip on grain boundaries. It was shown that reflection from such an interface is much stronger than from a rigid bond. A device was designed based on the diffraction of waves on periodic gratings. An anomalous phenomenon was found in the reflection of elastic waves from an interface between anisotropic crystals. It was found that the domain of permissible incident angles splits into disjoint pieces for certain crystal cuts. In this way, a new branch for the reflection coefficient was found. A sample from a Ni crystal was prepared. Another experiment was carried out on critical angles in backscattering. The general computer programs are being adapted to interactive algorithms for the PDP-11 with real time plotting of results on graphic displays. The Schlieren Visualization System was improved by adding capabilities for visualization of impulse ultrasonic signals.

4206 Safety Engineering

11769 **(CONF-8510118—) DOE natural phenomena hazards mitigation conference: proceedings.** (Lawrence Livermore National Lab., CA (USA)). Oct 1985. Contract W-7405-ENG-48. 237p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE86001557.

From DOE's natural phenomena hazards mitigation conference; Las Vegas, NV, USA (7 Oct 1985).

The conference includes sessions which present an overview of DOE programs, available codes, standards and criteria, examples of designs and upgrades from the DOE complex, lessons learned from past natural phenomena, ground motion, seismic evaluation of equipment, and applications of probabilistic risk assessment techniques to DOE facilities. Separate abstracts have been prepared for individual papers. (ACR)

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 11478

11770 **(DOE/OR/21400—T213) Temperature dependent electron transport studies for diffuse discharge switching applications.** Hunter, S.R.; Carter, J.G.; Christophorou, L.G.; Spyrou, S.M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004213.

A diffuse gas discharge switch must be capable of high speed, repetitive switching without significant degradation of its electron conduction and opening characteristics if it is to be useful in pulsed power switching applications. Whenever the switch is fired, the gas temperature T within the switch is expected to rise several degrees centigrade, and operating temperatures of several hundred degrees are likely for repetitively operated switches. The electron transport and rate coefficients, such as the electron drift velocity and the electron attachment coefficient for the most promising gas mixtures under study are expected to be funcions of T, and consequently, knowledge of these parameters as a function of T is desirable for modeling the operation of the diffuse discharge switch in practical application. Meausrements of these parameters in C_3F_8/buffer gas (Ar, CH_4, N_2) mixtures have been made and are reported. The electron attachment rate constant has also been measured for C_4F_8 and C_5F_8 as a function of the mean electron energy over the temperature range $300 \leq T \leq 750$ K. For C_4F_8, the electron attachment rate constant has been found to increase by 30% over this temperature range, while for C_5F_8, the attachment rate constant first decreases when the temperature is increased to ~450 K and then significantly increases with increasing T. An interpretation of these measurements and their significance in repetitively operated diffuse discharge switching gas mixtures is outlined.

11771 **(EPRI-EL—4376) Optical temperature sensors for transformers. Final report.** Saaski, E.W. (Sigma Research, Inc., Richland, WA (USA)). Jan 1986. 29p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920113.

An optical sensor system that safely measures transformer temperatures in areas of high electric stress has been developed using a combination of fiber optics and special temperature-sensitive optical sensors. This new technology permits direct measurement of transformer winding temperatures - unlike conventional techniques, which measure simulated "hot spot" temperatures.

11772 **(EPRI-EL—4381-Vol.1) Characteristics of insulating oil for electrical applications. Volume 1. Evaluation of insulating oils for use in transformers, capacitors, and cables. Final report.** Frey, R.M.; Gedemer, T.J.; Gauger, G.A. (McGraw-Edison Co., Franksville, WI (USA)). Jan 1986. 197p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920111.

Objective of this work was to evaluate various types of electrical insulating fluids to determine their suitability for use in electrical equipment. The samples were made up of insulating paper and copper so constructed that they could be electrically energized at 75 volts per mil. The units, containing approximately 200 cc's of oil, were made of steel and included an insulating bushing in the cover to allow energizing of the copper-paper wound pack. Some units were nitrogen blanketed, others were free breathers. Standard ASTM tests were used to evaluate the oil and paper at two or three week intervals until completion of the test. The results obtained showed that paraffinic oils can be defined to be "as good as" or "better than" presently used naphthenic oils. This work also showed that minicapacitors can be used to evaluate any changes in unit performance which material modifications may produce.

11773 **(EPRI-EL—4381-Vol.2) Characteristics of insulating oil for electrical applications. Volume 2. Effect of copper and aluminum on two types of paraffinic insulating oils. Final report.** Frey, R.M.; Gauger, G.A. (McGraw-Edison Co., Franksville, WI (USA)). Jan 1986. 65p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920112.

Objective of this work was to evaluate the effect of copper and aluminum on two types of paraffinic insulating oils. Sampling was performed every four weeks, so that the rate of deterioration of the oil and paper could be determined. Standard ASTM tests were used to evaluate the oil at four week intervals. The paper was evaluated at eight week intervals using thermogravimetry. Results show little difference on nitrogen blanketed units except for hydrogen and methane dissolved gas contents. On the free breathing units there were differences on the electrical tests and the neutralization number, with the aluminum wound units having the better values.

11774 **(SAND—85-1199) Design of a low-noise fiber-optic transmitter module.** LeGalley, R.R. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1985. Contract AC04-76DP00789. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004976.

This report describes the design of a fiber-optic transmitter module. This design increases the signal-to-noise margin by reducing crosstalk between adjacent transmitters. Further improvement was obtained by reducing electromagnetic interference through the use of shielding.

11775 **Precision limits of lock-in amplifiers below unity signal-to-noise ratios.** Gillies, G.T.; Allison, S.W. (Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee 37831). *Review of Scientific Instruments;* **57**: No. 2, 268-270(Feb 1986). Contract AC05-84OR21400.

An investigation of noise-related performance limits of commercial-grade lock-in amplifiers has been carried out. The dependence of the output measurement error on the input signal-to-noise ratio was established in each case and measurements of noise-related gain variations were made.

11776 **Baseline compensation circuit for measurement of transient signals.** Janata, E. (Hahn-Meitner-Institut fuer Kernforschung Berlin GmbH, Bereich Strahlenchemie, Glienicker Str. 100, D-1000 Berlin 39, West Germany). *Review of Scientific Instruments;* **57**: No. 2, 273-275(Feb 1986).

An automatic compensation circuit (back-off circuit) is described which incorporates a sample-and-hold amplifier with a digital memory in order to avoid droop problems at long durations of measurement. This device is helpful in pulse radiolysis and laser-flash photolysis experiments on the nanosecond to second timescale. The range of current compensation is +- 5 mA. The resolution is +- 1.27 μA and the accuracy is better than +- 1% for a range of compensation of 0.15 to 5 mA. A voltage output is provided as a measure (1 V/mA) of the compensated current.

11777 **Generalized nonlinear harmonic gyrotron theory.** Danly, B.G.; Temkin, R.J. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **29**: No. 2, 561-567(Feb 1986). Contract AC02-78ET51013.

The nonlinear efficiency for a gyrotron oscillator operating at harmonics of the cyclotron frequency has been calculated and is presented as a function of generalized parameters for the second through fifth harmonics. The numerical results are valid for a wide range of operating conditions, including voltage, current, beam radius, cavity dimensions, and operating mode. Relatively high efficiencies are found even at high harmonics; the maximum transverse efficiencies for harmonics 2, 3, 4, and 5 are 0.72, 0.57, 0.45, and 0.36, respectively. The calculation of the efficiency in terms of generalized parameters allows the straightforward design and optimization of harmonic gyrotrons. The influence of the axial profile of the rf field in the gyrotron cavity on the efficiency is also investigated. Improved efficiency can be achieved with asymmetric field profiles. The implications of these results for the generation of millimeter and submillimeter wave radiation by harmonic emission are discussed.

11778 **Simple technique for separating the effects of interface traps and trapped-oxide charge in metal-oxide-semiconductor transistors.** McWhorter, P.J.; Winokur, P.S. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **48**: No. 2, 133-135(13 Jan 1986).

A new technique is presented for separating the threshold-voltage shift of a metal-oxide-semiconductor transistor into shifts due to interface traps and trapped-oxide charge. This technique is applied to threshold-voltage shifts on an n-channel transistor that result from ionizing radiation.

11779 **Nonsaturable microdryer.** Hirschfeld, T. B. (to The United States of America as represented by the United States Department of Energy). US Patent 4,528,078. 9 Jul 1985. Filed date 23 May 1984. vp.

PAT-APPL-612954.

A nonsaturable microdryer is provided for electrolytically removing moisture from sealed containers, particularly electronic equipment. An electrode/electrolyte assembly is disposed within a channel between the interior and exterior of a sealed container. A catalytic barrier disposed between the interior of the sealed container and the electrode/electrolyte assembly prevents the build-up of explosive concentrations of hydrogen by converting back-diffusing hydrogen and oxygen back into water, which is then recycled. A semipermeable membrane disposed between the exterior of the sealed container and the electrode/electrolyte assembly allows selective removal of hydrogen and prevents intake of water.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 11483, 11730

11780 **(AD-A—158792/2/XAB) Criteria for ignition in monopropellant engines.** Benziger, J.B.; Strong, J.E. (Princeton Univ., NJ (USA)). Apr 1985. 4p. NTIS, PC A02/MF A01.

Hydrazine-based monopropellants are a mature technology. Because of suspected carcinogenity of hydrazine, the feasibility of nitromethane-based monopropellants was studied. Nitromethane-based systems can deliver high specific impulse; but the high adiabatic decomposition temperature limits the choice of catalyst material to metal oxides that exhibit significant activation barriers for reaction, necessitating a catalyst-bed preheat to function. For two of the best catalysts, NiO and Cr_2O_3, a minimum catalyst-bed preheat temperature for ignition was observed. Furthermore, the response time of the pressure exhaust time of the pressure exhaust from the catalyst-bed was optimal at intermediate values of fuel flow and catalyst-bed preheat. A model is presented that can account for those observations and provide guidelines for operation of nitromethane-based monopropellant systems. The monopropellant reactor is a packed-bed catalytic reactor. The system is adequately described as an adiabatic, plug-flow, two-phase reactor. The two performance criteria of intereste were (1) the operating conditions for lightoff and sustained operation, and (2) the operating parameters to optimize the response time. Reactor performance was examined for three design and control parameters: fuel feed rate, feed temperature, and bed pre-heat temperature.

11781 (AD-A—158859/9/XAB) Measurements of distributed combustion. Annual report, March 1983-June 1984. Braithwaite, P.C.; Beckstead, M.W. (Brigham Young Univ., Provo, UT (USA). Dept. of Chemical Engineering). Sep 1984. 60p. NTIS, PC A04/MF A01.

A modified Rijke burner was designed and constructed for use in evaluating the influence of particles on acoustic waves. A paddle is used with the burner that can be inserted into the flow field, suppressing oscillations on command. Withdrawal of the paddle allows growth of the oscillations. Experimental results obtained using Al and ZrC in the Rijke burner indicate that both additives cause an increase in the acoustic growth rate when compared to growth rates obtained without any particles in the system. The increase caused by Al is greater than that caused by ZrC. Because the reaction of Al releases more than twice the energy ZrC does, it would be expected to have a greater influence on the system than ZrC. The increase in the acoustic growth rate is the result of energy being added to the system by the distributed combustion of the particles. The increase in the acoustic growth rate due to distributed combustion was found to be directly related to the heat of reaction.

4220 Underground Engineering

REFER ALSO TO CITATION(S) 10748, 12175

4240 Pollution Control Equipment

11782 (AD-A—158804/5/XAB) Elution of benzene and methyl ethyl ketone from charcoal beds by continued air sweeping. Interim report, March 1983-November 1984. Thompson, J.K.; Jonas, L.A.; Walker, B.E. (Naval Research Lab., Washington, DC (USA)). 4 Sep 1985. 26p. (NRL-MR—5643). NTIS, PC A03/MF A01.

Activated carbon, or charcoal, is commonly used in adsorption beds to remove unwanted vapors from air in ventilating systems and in personal protective respirators. The vapor molecules become trapped by adsorption on the extensive surface of the charcoal and hence are removed for the air stream. However, this trapping is not permanent. These adsorbed molecules can desorb again into the passing air stream and be carried along to another adsorption site, where the cycle is repeated. Thus, a dose of vapor fed into a charcoal bed under a continous flow of air will migrate as wave through the bed and subsequently will appear as a concentration peak in the effluent air stream. The questions arise, then - especially if the vapor is a hazardous material: how long will it take for the eluted vapor dose to appear in the effluent; and how to characterize the kinetics of the process in terms of the Wheeler desorption equation. Test tube-sized beds of Whetlerite were challenged with benzene or methyl ethyl ketone (MEK) in doses less that required for break-through. Then, as air sweeping continued, time and concentration of the benzene or MEK elution peaks were observed and found to be predictable functions of the dosage. The results were also analyzed by adsorption/desorption which were derived were monotonic functions of the degree of carbon loading.

43 PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 11118

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 12471

11783 (BNL—37310) Status of the National Synchrotron Light Source upgrade. Culwick, B.B.; Smith, J.D. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 9p. (CONF-8510194—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005055.

From 2. international workshop on accelerator control systems; Los Alamos, NM, USA (7 Oct 1985).

The demands for real-time control, data acquisition and display from accelerators of the National Synchrotron Light Source have exceeded the capabilities of the computer control system designed in 1978. In January 1985, a workshop on control systems was held at Brookhaven, one of the purposes of which was to provide impetus and design goals for an upgrade of the NSLS control system. The resulting design is described and its status reported.

11784 (DOE/ER—0255) Report of the HEPAP Subpanel on Advanced Accelerator R and D and the SSC. (USDOE Office of Energy Research, Washington, DC. High Energy Physics Div.). Dec 1985. 107p. NTIS, PC A06/MF A01; GPO Dep. File Number DE86004754.

Advanced accelerator research is reviewed with focus on its possible impact on the Superconducting Super Collider (SSC). The technical status of high energy electron-positron linear colliders is assessed. Experience is reviewed in the areas of storage ring physics and the technology of superconducting magnets. Areas are identified where progress is required for a high energy linear collider to be feasible, and progress and prospects in these areas are reviewed. The work on linac structures powered by either a microwave tube or a free electron laser are reviewed, and other more advanced concepts are discussed, such as plasma accelerators, wakefield accelerators, switched power accelerators, and inverse Cherenkov accelerators. (LEW)

11785 (DOE/ER/10565—10, pp 98-99) Study of the dee-to-dee shielding. Laune, B.; Rogers, R.C. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

In the K500 cyclotron, the dees are not electrically shielded from each other in the central region, thus making necessary the use of neutralizing links in order to operate each dee independently. In the MSU K500 cyclotron these links are located on the dee stems, resulting in some reduction of the high frequency range. A more direct and frequency independent solution to this problem was investigated: why not directly shield the dees in the center region? To test such a solution, detailed calculations of the orbits were performed. The electric field was calculated by the code RELAX3D, which solves the Laplace equation in a regular three dimensional mesh. The magnetic field was produced by the MSU codes TCFIT500 and FLCK500, using actual magnetic data from the MSU K500 cyclotron. Finally these data were used by the MSU code CYCLONE which computes the orbits.

11786 (DOE/ER/10565—10, pp 100-101) Statistics of cyclotron operation. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The 88 inch cyclotron was scheduled for operation 20 shifts per week during this period with one shift scheduled for maintenance. Operational time for the period is summarized. The distribution of scheduled time among users is shown. Beam development was carried out in 650 hours. Polarized and unpolarized proton and deuteron beams, alpha particles, ^{14}N, ^{16}O, ^{40}Ar, and ^{84}Kr were the beams most in demand. The use of polarized beams rose dramatically from the previous year with 553 hours of actual running.

11787 (DOE/ER/10565—10, pp 106-109) Proton beam position and intensity monitors. Gagliardi, C.A.; Mihara, Y.; Tribble, R.E.; Whiddon, C.S. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

Modulations of the polarized proton beam position or intensity correlated with the spin flip may introduce serious systematic errors in the anti p-p parity violation experiment. Modulations at other frequencies (notably 60 Hz and its harmonics) do not lead to additional systematic error, but they do increase the counting time necessary because they increase the noise seen by the lock-in amplifiers. Last year, we gave a preliminary report on our development of secondary electron emission monitors to measure these fluctuations, together with a feedback system to enhance or reduce them, as desired. Since that time we have had extensive experience with these monitors. They have proven to be powerful diagnostic tools, not only for understanding the coupling of the proton spin to other

beam properties, but also to identify problems with the cyclotron and beam transport systems as well.

11788 **(LBL—19540) Effect of oxygen concentration on the corrosion of molybdenum in flowing water.** Wells, R.P. (Lawrence Berkeley Lab., CA (USA)). Nov 1985. Contract AC03-76SF00098. 4p. (CONF-851102—75). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005221.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

Corrosion of molybdenum tubes used in actively water cooled particle accelerators has become a concern in both the positive and negative ion based neutral beam programs at the Lawrence Berkeley Laboratory (LBL). To ascertain the effect of dissolved oxygen concentration in the corrosion of molybdenum accelerator grid rails, weight loss from samples subjected to flowing Low Conductivity Water (LCW) of various oxygen concentrations was monitored over several weeks. The results indicate that the corrosion of molybdenum tubes can be reduced to acceptable levels by limiting the oxygen concentration in the water. 4 refs., 4 figs., 1 tab.

4302 Beam Dynamics, Field Calculations, And Ion Optics

11789 **(BNL—51927) Particle dynamics for motion in a non-planar accelerator.** Antillon, A.; Month, M. (Brookhaven National Lab., Upton, NY (USA)). 20 Aug 1985. Contract AC02-76CH00016. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005303.

The basic dynamics of a planar accelerator is extended to the non-planar case. This is done using the geometrical concept of torsion and extending the Hamiltonian formalism. A generalized non-planar reference orbit is adopted which introduces torsion in appropriately chosen drift spaces. The parameters of the reference orbit are associated with uncoupled and coupled betatron parameters currently in use.

11790 **(SLAC/AP—47) Emittance growth from radiation fluctuations.** Sands, M. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Dec 1985. Contract AC03-76SF00515. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005085.

As an electron bunch travels through a transport system, fluctuations in the energy loss of individual electrons cause the size of the bunch to grow. A calculation is given of the quantum-induced growth of the emittance of a beam in one transverse coordinate, making the following approximations: (1) that the transport system is linear; (2) that there is no coupling between the two transverse motions; and (3) that the radiation effects can be described by their values on the central design trajectory. This last assumption means that systems are considered in which the quantum effects from bending magnets are much larger than from the focusing lenses.

11791 **(UCID—20615) Beam breakup and the conceptual design of guided and unguided accelerators.** Caporaso, G.J. (Lawrence Livermore National Lab., CA (USA)). Oct 1985. Contract W-7405-ENG-48. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004907.

A series of drawings illustrate the beam breakup instability, laser guiding, quadrupole channels, phase mix damping, and cavity model. Model equations are solved for a continuous beam breakup model. (LEW)

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 12308

11792 **(BNL—37156) Recent developments at TRISTAN: nuclear structure studies of neutron-rich nuclei.** Gill, R.L. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 7p. (CONF-850942—45). NTIS, PC A02/MF A01; GPO Dep. File Number DE86003380.

From 190. American Chemical Society national meeting; Chicago, IL, USA (8 Sep 1985).

The nuclear physics program at the fission product mass separator, TRISTAN, has greatly expanded, both in the types of experiments possible and in the range of nuclei available. Surface ionization, FEBIAD, high-temperature thermal, high-temperature plasma, and negative surface ionization ion sources are routinely available. Experimental facilities developed to further expand the capabilities of TRISTAN include a superconducting magnet for g-factor and Q/sub β/ measurements, a windowless Si(Li) detector for conversion electron measurements, and a colinear fast-beam dye laser system for hyperfine interaction studies. This combination of ion sources, experimental apparatus, and the long running time available at a reactor makes TRISTAN a powerful tool for nuclear structure studies of neutron-rich nuclei. The effect of these developments on the nuclear physics program at TRISTAN will be discussed and recent results from some of these facilities will be presented. 6 refs., 3 figs.

11793 **(BNL—37314) Beams for kaon research.** Pile, P.H. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 16p. (CONF-850921—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005058.

From 5. international conference on hypernuclear and kaon physics; Upton, NY, USA (9 Sep 1985).

A proposed 1-2 GeV/c kaon beam line for BNL, designed to deliver momentum analyzed negative kaon beams with intensities above 10^6 per spill, is discussed. The beam intensity is expected to be about an order of magnitude greater than presently available and it is expected to be a clean beam with no more than 1:1 $(\pi^-,\mu^-,e^-)/K^-$. The beam line will allow a detailed investigation of strangeness -2 systems as well as continued investigations of strangeness -1 systems.

11794 **(CBPF-NF—073/83) Ondulators and Wigglers - Theoretical aspects.** Tsallis, C. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1983. 15p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700410.

A physical analysis of the effects shown by Wigglers and Ondulators which control the synchrotron radiation in a storage ring is presented.

11795 (DOE/ER/10565—10, pp 88-89) **K500 cyclotron magnet.** Derrig, G.; Smelser, P. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

In January 1985 the lower polecap of the main magnet for the Texas A & M K500 Superconducting Cyclotron was placed in position. Since that time work has been proceeding with the installation of the pole tip assemblies, center plugs, magnetic shims and other items in preparation for the magnetic field mapping program. The helium refrigeration system was dropped during installation in July 1984. Repair to the system required opening the cold box and replacing the low temperature exchanger. The repaired refrigerator was installed and operated in January 1985. The magnet coil is in the final stages of assembly. The coil complete with the insulation and liquid nitrogen cooled radiation shield, has been installed in the coil tank. Fitting and welding of the median plane penetrations is progressing.

11796 (DOE/ER/10565—10, pp 101-102) **Computer systems.** Bronson, J.D.; Cowden, T.; Haenni, D.R.; Hargis, C. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The main computing facilities at the Cyclotron Institute are provided by two five year old VAX 11/780 systems. One system is normally used for data acquisition (ACQ) while the other is for data analysis (COMP). The configuration of the two machines is shown. A vintage PDP-15/40 which had serviced the data acquisition needs of the Institute for over a decade has been removed and the additional space will be used to provide more room for experimental setups.

11797 (DOE/ER/10565—10, pp 89-90) **Main magnet power supply.** Reimund, J. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The K500 main magnet power supply system has been completed and successfully tested into resistive dummy loads at full operating current. The tests centered on overall functionality of the system since such things as current ripple, current ramping, and stability can only be tested when using the main magnet coils as the load. Controller functions that set the magnet currents and ramp/discharge rate worked well and allow currents and voltages to be entered with a resolution of about 8 mA and 0.2 V respectively. When regulating at the full load current of 800 amps, both the SCR supplies and the power FET passbanks remained well below their maximum safe operating temperatures. In fact, because so little power, between 400-700 watts, is being dissipated in the passbanks during regulation there is no noticeable temperature rise. When the magnet becomes available tests of the long term stability and regulation will be conducted.

11798 (DOE/ER/10565—10, pp 90) **Trim coil power supplies.** Haisler, R.; Peeler, H.; Zajicek, W. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The 18 trim coil power supplies have been constructed and are now in place in the K500 pit and pit mezzanine. Final wiring of the primary power and control power is proceeding along with installation of cooling water supplies. The supplies are expected to be ready for final testing into resistive loads at the beginning of June, 1985.

11799 (DOE/ER/10565—10, pp 91) **K500 RF power supply.** Abegglen, F.; Foy, J.; St. John, L. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The K500 RF power supply and interlock system was completed and successfully tested into a dummy load at an output of 20 KVDC at 20 amps in January, 1985. The RF power supply, located in the north end of the old high bay area, consists of one common anode supply with three decoupled outputs, three separate screen grid power supplies and three separate control grid power supplies.

11800 (DOE/ER/10565—10, pp 91-94) **K500 RF system.** Rogers, R.C. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The discussion of the design of the RF system in the past two issues of the annual progress report has dealt mainly with characteristics of the resonator structures. It was necessary that these analyses be as complete as possible so that the behavior of the resonators would be well understood. The eventual performance of the overall system is cast in the stone of the resonator design which can be little modified after construction begins. The general design of the resonators using the tapered impedance dee stems and reduced diameter corona shields is as described in the last report. During the past year the dee stem insulators and the tapered inner conductors which are unique to this system have been received and accepted. Most of the mechanical design emphasis is now being placed on adequate cooling and ease of assembly and maintenance.

11801 (DOE/ER/10565—10, pp 99-100) **Computer aided design.** Bronson, J.D.; Cowden, T.; Haenni, D.R.; Hargis, C. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The research program at the Cyclotron Institute frequently requires special purpose printed circuit boards. These are used either in data acquisition equipment or for control of an experiment. Also during this period of building the new K500 machine, many special boards will be needed for the computerized control system. Due to the very tedious and time consuming process of producing a printed circuit board by the usual drawing techniques, an inexpensive computer aided design (CAD) system was sought. Such a system of software, called P-CAD EDA, was purchased from Personal CAD Systems Inc. and the required hardware to run it was assembled. This hardware consisted of equipping an IBM PC with 640 kilo-bytes of memory, a 20 Mbyte hard disk drive, 2 floppy disk drives, a color monitor, a Calcomp 1043 plotter, a mouse and an Epson FX-80 printer. A block diagram of the system is shown.

11802 (DOE/ER/40124—7) **Superconducting tests of beta = 0.1 and beta = 0.2 resonators.** Storm, D.W.; Amsbaugh, J.F.; Corcoran, D.T.; Howe, M.A. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1985. Contract AC06-84ER40124. 11p. (CONF-851040—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004291.

From Symposium of northeastern accelerator personnel; Argonne, IL, USA (14 Oct 1985).

Several low beta (0.10) and two high beta (0.21) lead plated copper quarter wave resonators were cooled down, multipactor conditioned, tested, helium conditioned, and retested. The choice of the quarter wave resonator and of the lead plated copper technology is discussed. The fabrication is described and techniques for conditioning the resonators are presented. Performances are presented. 5 refs., 4 figs.

11803 (INIS-mf—10006) **Polarized ^{3}He ion source for the Van de Graaff based on the 2^3S_1 state of helium. Progress report.** Slobodrian, R.J.; Labrie, R.; Voisine, D.C. (Laval Univ., Quebec City (Canada). Lab. de l'Accelerateur van de Graaff). Dec 1982. 67p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE86780346.

We have reached an important stage in the construction of a source of polarized ^{3}He ions since the end of June, 1981, when a grant was received for its construction. The production of an intense beam of metastables in the 2^3S_1 state has been achieved, as well as Stern-Gerlach separation. We have set up a method of recirculating gas in the metastable production step, which permits the operation of the polarized ion source in the same way as an ordinary ion source. The design of the adiabatic transition according to the method of Abragam and Winter was prepared. We are now studying ionization methods. The fact that the ionization potential is very low allows us to envisage nontraditional methods for this type of ion source. These methods permit high ionization efficiency. The objective set out at the beginning, a source of polarized ^{3}He ions producing 100 nA-Particle with a polarization of 80 percent will be surpassed easily by our source.

11804 (INIS-SU—308, pp 46-51) **Curved crystal spectrometer of Johansson type.** Vagner, V.; Dunin, V.B.; Karrash, G.; Krejzler, D.; Nevskaya, N.A.; Shul'tse, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods); Shchornak, G. (Technische Univ., Dresden (German Democratic Republic)). 1985. (In Russian). NTIS (US Sales Only), PC A04/MF A01. File Number DE86780239.

In JINR rapid communications. Collection of papers.

A curved crystal spectrometer of Johansson type has been put into operation. The radius of Rowland focus circle is R=324 nm. For any Bragg angle in the 7 deg <= theta <= 70 deg range the focusing condition is realised. The spectrometer is connected to a MERA-60/30 computer via CAMAC interfaces. The deviation of angle theta is measured by a laser interferometer. The smallest step of angle measuring comprises 0.01 arc sec in a variable range of 12 degrees. A system with the piezodriver sets the needed theta value with minimum step of 0.23 arc sec in the 3 arc min range. The study of spectrometer resolution was carried out with SiO_2 crystal cur over (13 anti 40) plane (d=2.178 A) and curved by Johansson principle. FWHM of CuKsub(α1) reflex given by X-ray tube was 4.6 eV. The spectrometer optical mechanical system gives an accuracy of repeated angle scale Δtheta <= 2 arc sec. The spectrometer light efficiency with X-ray source, placed on a focal circle R, is of the order of (4 - 8) x 10^{-8} depending on theta. The parameters of apparatus permit to separate K lines of neghbouring charge states with ionization values I > Z/2 for Z >= 30.

11805 **(LBL—19395) 6.4 Tesla dipole magnet for the SSC.** Taylor, C.E.; Caspi, S.; Gilbert, W.; Meuser, R.; Mirk, K.; Peters, C.; Scanlan, R.; Dahl, P.; Cottingham, J.; Hassenzahl, W. (Lawrence Berkeley Lab., CA (USA); Brookhaven National Lab., Upton, NY (USA)). May 1985. Contract AC03-76SF00098. 12p. (CONF-850814—33). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86002897.

From Cryogenic engineering conference and international cryogenic materials conference; Boston, MA, USA (12 Aug 1985).

A design is presented for a dipole magnet suitable for the proposed SSC facility. Test results are given for model magnets of this design 1 m long and 4.5 m long. Flattened wedge-shaped cables ("keystoned") are used in a graded, two-layer "cos θ" configuration with three wedges to provide sufficient field uniformity and mechanical rigidity. Stainless steel collars 15 mm wide, fastened with rectangular keys, provide structural support, and there is a "cold" iron flux return. The outer-layer cable has 30 strands of 0.0255 in. dia NbTi multifilamentary wire with Cu/S.C. = 1.8, and the inner has 23 strands of .0318 in. dia wire with Cu/S.C. = 1.3. Performance data is given including training behavior, winding stresses, collar deformation, and field uniformity.

11806 **Inductively insulated Marx generator.** Rhee, M.J. (Electrical Engineering Department and Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Review of Scientific Instruments;* **57**: No. 2, 170-172(Feb 1986).

We describe a modified Marx generator system in which each capacitor stage is insulated by an inductive cavity instead of by insulating dielectric eliminating most of the insulation volume and circuit inductance which are inevitable in the conventional Marx generator system. This feature permits use of this system as a fast pulsed power system of very high voltage by stacking a very large number of stages. Necessary relations needed for pulsed power applications are derived by a simple circuit analysis. Design parameters of a charged particle beam accelerator are given as an example illustrating the utility of this concept.

4304 Storage Rings

REFER ALSO TO CITATION(S) 11784

11807 (DOE/ER/02504—423, pp 31-53) **OPAL experiment at LEP: P. Rapp progress report.** Chang, C.Y.; Glasser, R.G.; Kellogg, R.; Sechi-Zorn, B.; Skuja, A.; Snow, G.; Steinberg, P.; Zorn, G.T. (Univ. of Maryland, College Park). Oct 1984. NTIS, PC A06/MF A01. File Number DE85008093.

In High energy accelerator and colliding beam user group. Progress report, March 1, 1984-February 28, 1985.

Excellent progress has been made on all major fronts in this complex collaboration. The magnet construction has begun. The central detector prototypes have been tested and give excellent results. All CERN Review Committee Conditions and milestones are being met in a timely fashion. Financial approval for all major parts of the detector have been obtained from the respective governments and institutions involved, although some financial problems remain when compared to the total requirements of the experiment. Commitments for the physical layout and assembly areas for the various parts of the detector have been obtained and a detailed timetable for construction and assembly have been provided. Some difficulties still remain with respect to the installation time scale. The software problems have been defined and are beginning to yield to the large and steady efforts being made on them. A third US Group, UC Riverside, lead by Prof. Ben Shen has been given conditional acceptance in the OPAL collaboration. In the following is presented (1) a hardware development progress report by Pat Rapp, (2) a detailed overview of the schedule for production and assembly of the OPAL hadron calorimeter, prepared by Gus Zorn, and (3) a status report by C.Y.Chang on Monte Carlo simulation of the BNL test beam hadron calorimeter results (reported last year) for insertion in the overall Hadron Milestone Report being prepared by the OPAL Hadron Calorimeter Group.

11808 (DOE/ER/02504—423, pp 69-72) **Electron ring design for HERA, including spin-matching.** Skuja, A.; Hand, L.; Steffen, K.; Barber, D. Oct 1984. NTIS, PC A06/MF A01. File Number DE85008093.

In High energy accelerator and colliding beam user group. Progress report, March 1, 1984-February 28, 1985.

A. Skuja has been working in collaboration with Professor Lou Hand in obtaining an optics for the electron ring at HERA that satisfies the usual constraints of an electron storage ring, but in addition allows longitudinal polarization in the interaction region without depolarizing the electron beam completely. This collaboration effort grew out of their work on a possible electron ring at Fermilab. When this project was degraded in priority at Fermilab, they turned their attention to the HERA project at DESY. The HERA project will have an electron ring of about 30 GeV e^- (or e^+) incident on 800 GeV protons. Recently it has been decided that the collisions should be head on (0^0 crossing), although all previous designs had a crossing angle of the 2 beams of 20 mrad. Professors Hand and Skuja implemented a complete program in the last year and a half that could fit the usual Turis parameters as well as the so called 12 spin-matching conditions of Chao and Yukoya for all possible machine elements including solenoids. The program has the possibility of fully coupling vertical and horizontal motion using the usual eigenvalue method.

11809 **(FNAL-TM—1360) Initial estimate of transmission line effects in SSC Design D magnets.** Calvo, O.; Tool, G. (Fermi National Accelerator Lab., Batavia, IL (USA)). Dec 1985. Contract AC02-76CH03000. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004696.

The response of the SSC accelerator magnet string to transient excitation from the power supply is considered. Some criteria for the selection of the optimum damping resistors for the SSC magnets are discussed. Once the damping resistors are chosen, the transient response of the load to power supply transients, including the effect of the power supply filter is analyzed. A comparative analysis is made of the differences between two possible configurations in the distribution of the magnets (with and without a return bus).

11810 **(LAL-RT—84-04) Survey of fully antisymmetric rotators for the electron rings HERA and LEP.** Buon, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Nov 1984. 7p. (CONF-8409162—21). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750377.

From 6. international symposium on high energy spin physics; Marseille, France (12 Sep 1984).

A systematic study of fully antisymmetric rotators made of six magnets each is presented for HERA and for LEP. The maximum polarization, that could be obtained with them, is lower than with horizontally symmetric minirotators as it results from the antisymmetry and from the space available for installing these antisymmetric rotators.

11811 **(LAL-RT—84-05) Resonant depolarization in electron storage rings equipped with "siberia snakes".** Buon, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Nov 1984. 6p. (CONF-8409162—20). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750372.

From 6. international symposium on high energy spin physics; Marseille, France (12 Sep 1984).

Resonant depolarization induced by field errors and quantum emissions in an electron ring equipped with two "siberian snakes" is investigated with a first order perturbation calculation. It is shown that this depolarization is not reduced by the snakes when the operating energy is set out of the depolarization resonances.

11812 **(LAL-RT—84-06) Suppresion of beam-beam depolarization.** Buon, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Nov 1984. 5p. (CONF-8409162—19). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750370.

From 6. international symposium on high energy spin physics; Marseille, France (12 Sep 1984).

"Spin matching" condition has been previously derived for suppressing beam-beam depolarization in electron storage rings independently of the magnitude and of the non-linear feature of the beam-beam interaction. Limitations and compatibility with other "spin matching" conditions are discussed.

11813 (LAL-RT—84-13) DCI operation balance during DM2,γγ - LURE - LEP vacuum - PS- vacuum experiments (September 1983-December 1984). Besson, J.C.; Raynaud, M. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Dec 1984. 21p. (In French). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750374.

This report concludes the DCI operation for high energy physics. Performances have been constantly increasing thanks to an increased reliability of DCI and its auxiliaries and to an amelioration of routine of beam fitting. This amelioration has been helped by dimension augmentation of the vacuum chamber allowing an easier injection and work with a beam going round at the energy of the psi. For the synchrotron radiation uses, operation routines allowing a work at 1850 MeV energy have been fitted.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 11080, 11804, 11807, 12148, 12153, 12155, 12174, 12283, 12380, 12387

11814 (DOE/ER/04699—T2) Possible uses of the DLS dipoles in a search for the quark-gluon plasma at the AGS. Kirk, P.N. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 22 Apr 1985. Contract AS05-76ER04699. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004846.

The possible use of dipole magnets in an experiment to search for the quark-gluon plasma is discussed, specifically the two dipole magnets based on the lampshade concept that are currently being constructed for use at LBL. A major advantage of this design is that the efficiency of pair detectors is almost independent of pair mass and transverse momentum over the entire range of interest. The efficiency does depend highly on the pair rapidity and the target location, however. (LEW)

11815 (DOE/ER/10565—10, pp 45-47) Design and calibration of an X-ray polarimeter. Pedrazzini, G.J.; Palinkas, J.; Watson, R.L. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The polarization of x rays from ion-atom collisions contains valuable information about the asymmetry of the excitation or ionization process. The alignment of the excited (ionized) atom can be characterized by the ratios of cross sections for populating the different magnetic substates, and is related to the polarization and anisotropy of the x rays emitted in the decay of the excited state. Therefore, by measuring the polarization of the x rays, the substate cross section ratios can be deduced. This report describes the design of a system for the measurement of x-ray polarization in ion-atom collisions and its application to the measurement of the polarization of the KL satellite lines of Al excited by 5.5 MeV He-ion impact.

11816 (DOE/ER/10565—10, pp 54-56) Performance of a grazing incidence spectrometer system employing a position sensitive microchannel plate detector for beam-foil measurements. Demarest, J.A.; Watson, R.L. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

A 1-meter grazing incidence spectrometer was adapted for in-beam experiments with the cyclotron this year. This instrument makes it possible to extend studies of radiation resulting from heavy-ion collisions into the extreme ultraviolet region. The inherent inefficiency of the grazing incidence spectrometer and the weakness of the beam-foil light source in this wavelength region makes it prudent to explore ways of improving the data collection efficiency. Recent reports of the employment of a position sensitive microchannel plate in a grazing incidence spectrometer and of the resulting improvement in detection efficiency by one to two orders of magnitude motivated the work described in this report. A Galileo 3508 chevron microchannel plate (MCP) with a resistive anode encoder (RAE) was first evaluated in a test configuration prior to mounting it on the grazing incidence spectrometer. In these tests, the MCP was mounted on a moveable frame located 5.6 inches above a (Manson) soft x-ray source. An adjustable slit was placed 0.35 inches in front of the MCP to restrict the illumination of the plate to a finite slice. The MCP could be moved across the slit by means of a micrometer drive. In this way, the linearity and response of the plate could be checked.

11817 (DOE/ER/10565—10, pp 65-67) IBM PC-based spectrometer control system. Pedrazzini, G.J. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The increasing availability of moderately priced, high capacity, microprocessor-based computers has spawned a wide variety of useful applications in the field of scientific research. Such a system has recently been adapted to function as a controller for x-ray crystal spectrometer systems and to display and log the data accumulated in heavy ion collision experiments. This compact, portable system will allow a greater flexibility in the present experimental program, which is currently tied to a central multi-user computer facility and suffers from the usual restrictions and compromises that such an environment imposes.

11818 (DOE/ER/10565—10, pp 102-103) Microchannel plate zero time detector. Majka, Z. (Institute of Physics of the Jagellonian Univ., Krakow, Poland). Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The detection and identification of nuclear reaction products require in general a measurement of three properties: (i) the total energy, (ii) the ionization rates, (iii) the velocity. A time-of-flight telescope employing a zero-time start detector and surface barrier stop detector is the most appropriate device for the mass identification ($A < 70$) and velocity measurements. In the case of heavy ion detection, negligible energy loss and angle straggling are required if particles pass through the zero - time detector. A thin foil zero-time detector which we have built recently satisfies the above requirements.

11819 (DOE/ER/10565—10, pp 103-106) Efficiency and response of the total energy counter. Sullivan, J.P.; Garg, U.; Haenni, D.R.; Lui, Y.W.; Toba, Y.; Yates, K.; Youngblood, D.H. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The total energy counter (TEC) is a large sixteen-element NaI detector with a solid angle coverage close to 4π. The TEC has been used to study gamma decays of the giant quadrupole resonance and other excited states in the giant resonance region. As a part of this study, the efficiency and response of the TEC have been calculated using the EGS code, which is a set of programs which use Monte Carlo methods to simulate the development of electromagnetic showers in any material. Some of the results of this calculation are presented here and are compared to the efficiency measured for 4.44 and 15.11 MeV gamma rays from ^{12}C excited via p,p' reactions.

11820 (DOE/ER/10565—10, pp 109-110) Parity violation in ^{2}H (vector p/sub e/, p) H scattering. Mihara, Y.; Gagliardi, C.; Tribble, R.; Betker, A.; Burch, R.; Kravis, S.; Semon, D.; Whiddon, S. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

In last years progress report we detailed a number of improvements that were made in our experimental setup to measure

parity nonconservation in the scattering of longitudinally polarized protons on ^{3}H. We had an extended run during the summer of 1984 to test the improvements and put all of the component parts together to carry out a new measurement of the longitudinal analyzing power at 50 MeV. During the run we uncovered two major defects in our detector, neither of which we had anticipated, that precluded us from completing a new measurement of the parity violation. One of the defects was in the plastic scintillator material and the other was in the construction of our Faraday cup.

11821 (FNAL-TM—1369) **Measurement of the magnetic field of the CDF magnet.** Yamada, R.; Newman-Holmes, C.; Schmidt, E.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1985. Contract AC02-76CH03000. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004699.

The magnetic field of the CDF (Collider Detector at Fermilab) superconducting solenoid has been measured using a newly designed field mapping device. NMR probes and a system of three orthogonal search coils were used as sensing elements. The central uniform region inside the solenoid coil and the fringing field in the conical end plugs were measured. The detailed field distribution and its characteristics are described.

11822 (FRNC-TH—2066) **Characterization of SIS functions in a heterodyne receiver at 33GHz.** Zaquine, I. (Grenoble-1 Univ., 38 - La Tronche (France)). Jan 1985. 142p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE86750390.

Superconductor-insulation-superconductor (SIS) tunnel junctions present a Volt-Ampere characteristic strongly nonlinear; its ideal limit is a discontinuity at the level of forbidden band voltage. Niobium-Oxide-Lead (Indium)or Niobium nitride-Oxide-Lead (Indium) junctions have been tested in mixing at 33GHz. The best result obtained in double band receiver temperature is 120K. The result analysis allow in statics to well characterize the performance of our first FET amplifier in the cold state and in dynamics to find the relative importance of the different parameters of the junction. SIS diode mixers have good performance in frequency field interesting the radioastronomy.

11823 (INIS-mf—9626-Vol.1, pp 173-177) **Application of Si detectors, photo-diodes and G-M counters in exposure rate measurements.** Novkovic, D.; Dobrilovic, L.; Orlic, M.; Paligoric, D.; Drndarevic, V.; Kovacevic, K.; Miric, P. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE85781216. (CONF-830995—Vol.1).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

The paper presents the results of the measurements of the following characteristics of Si detectors, Si photodiodes and GM counters: counter response vs. energy, counter response vs. temperature, angular dependance of the response, and the measuring range. These results show that these detectors could be applied for exposure rate measurements.

11824 (INIS-mf—9626-Vol.1, pp 178-182) **Investigations of a new thermoluminescent bulb dosimeter.** Feher, I. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE85781216. (CONF-830995—Vol.1).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

A sensitive $CaSO_4$:Dy (Tm) bulb dosemeter was developed. The minimal detectable dose is 1 μGy and the dose response curve is linear up to 10 Gy. The background due to self irradiation from the ^{40}K content of the glass tube of the bulb and the fading is low. The bulb dosemeter shows a good resistance against mechanical burden. Owing to the above properties, the new bulb dosemeter proves to be particularly useful in space dosimetry, personal dosimetry and environmental monitoring.

11825 (INIS-mf—9626-Vol.1, pp 183-188) **Characteristics of some TLDs for low dose measurement.** Ranogajec-Komor, M.; Vekic, B.; Dvornik, I. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)); Szabo, P.P. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics); Pal, S.P. (Central Research Institute for Physics, Budapest (Hungary).). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE85781216. (CONF-830995—Vol.1).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

The sensitivity, reproducibility, linearity fading and the light induced fading, light sensitivity, individual sensitivity and the lowest detectable dose of different TLDs were investigated in order to compare their suitability for low dose measurements.

11826 (INIS-mf—9626-Vol.1, pp 204-208) **Relative standard deviation of thermoluminescence dosimetry - comparison of the experiments with theory.** Zarand, P.; Polgar, I.; Katona, E.; Weisz, C. (Weil Emil Hospital, Budapest (Hungary), Oncoradiological Centre). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE85781216. (CONF-830995—Vol.1).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

Different LiF and $CaSO_4$:Tm powder measurements are in good agreement with those predicted on the base of three parameter theory. It was demonstrated that a Poissonian component is incorporated in the total variance of TL measurements. Confidence intervals of the three parameter predictions were determined by using Monte Carlo calculations.

11827 (INIS-mf—9626-Vol.1, pp 138-143) **Possible secondary standard for lethal dose measurements in radiological research and accident dosimetry.** Dvornik, I.; Miljanic, S.; Zivadinovic, M.; Dugonjic, B.; Ranogajec, M. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE85781216. (CONF-830995—Vol.1).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

A new secondary standard for gamma and neutron radiation dosimetry is proposed based on the liquid chemical system containing chlorobenzene, ethanol and the colour indicator dissolved in 2,2,4-trimethylpentane. Commercial personal dosimeters DL-M3(M4) based on this system are characterized by statistical examination of the visual readout method and of the obtained dosimetry results. It is concluded that this simple method can give accuracy and precision required for dosimetric standardization of radiation therapy, and that it can be used as an accurate transfer dosimeter in neutron dosimetry. Of special advantage is the possibility of accurate dosimetry performed by persons not professional in the field.

11828 (INIS-mf—9626-Vol.1, pp 158-162) **Measurement of the total specific alpha activity with silicon detector.** Dobrilovic, L.; Smelcerovic, M.; Paligoric, D.; Simovic, M.; Bojovic, T.; Drndarevic, V. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE85781216. (CONF-830995—Vol.1).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

This paper describes the procedures for determination of absolute counting efficiency of a counting device for total alpha activity measurement of infinitely thick sources prepared from environmental plant samples. Two procedures were used for preparation of thick sources: drying and grinding of plant samples into fine powder and wet ashing by H_2O_2/Fe^{2+}. A counting device based on silicon detector optimized to measure alpha particles in the presence of beta and gamma radiation was used.

11829 (INIS-mf—9626-Vol.1, pp 168-172) **Pocket gamma ray monitor including semiconductor detector and numerical display.** Drndarevic, V.R.; Koturovic, A.M. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE85781216. (CONF-830995—Vol.1).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

For designing small size, low power consumption gamma ray monitor the possibilities of convenient characteristics of commercially available semiconductor detector are used. The developed instrument unites possiblilities of adopted simple signal processing system and data indication. Realised pocket gamma ray monitor has good operating characteristics, and domain of use determined by the applied detector. Measurement of dose rate under 1 $\mu C \times kg^{-1}s^{-1}$ is possible with BPX-1400 semiconductor detector made by Videoton-Remix. Relative sensitivity of realised monitor in temperature range of -10°C to +40°C is less than 6%. Relative sensitivity lies between -4% and +0.5%, for voltage supply change of 3.3 V to 4.7 V. Characteristics of this solution are analysed and compared with cases when GM tube is used. Conclusions concerning the use of this type of solution are given.

11830 (INIS-mf—9626-Vol.2, pp 8-12) **New Monte Carlo electron transport code for beta dosimetry.** Petoe, A. (Hungarian Academy of Sciences, Budapest (Hungary). Inst. of Isotopes); Koblinger, L. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1984. NTIS (US Sales Only), PC A13/MF A01. File Number DE85781217. (CONF-830995—Vol.2).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

The main features of the BETRA Monte Carlo code are described. The performance of the code is illustrated with results obtained for the energy- and direction dependence of thermoluminescent LiF dosemeters and for the dose distribution in the human skin.

11831 (INIS-mf—9626-Vol.2, pp 25-29) **Present status of neutron detection in ATOMKI.** Medveczky, L. (Hungarian Academy of Sciences, Budapest (Hungary). Inst. of Nuclear Research). 1984. NTIS (US Sales Only), PC A13/MF A01. File Number DE85781217. (CONF-830995—Vol.2).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

The response of three solid state nuclear track detectors without any external irradiated with neutrons of the spectrum of moderated fission and the counting characteristics of spark counter evaluation on detectors of LR 115 strippable type irradiated with 14.7 MeV neutrons were studied.

11832 (INIS-mf—9626-Vol.2, pp 3-7) **Improved model of electron interaction with matter to be used for calculation of detector's response function.** Smelcerovic, M.; Markovic, P. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). 1984. NTIS (US Sales Only), PC A13/MF A01. File Number DE85781217. (CONF-830995—Vol.2).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

This paper deals with basis of an improved model of electron interaction with matter suitable for semiconductor detector's response function calculation. Comparison with other models is given.

11833 (INIS-SU—311, pp 10-14) **Facility for studying the cross sections of relativistic nuclear fragment strong interactions at the Dubna synchrophasotron.** Veresh, I.; Golutvin, I.A.; Gorbunov, N.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1984. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE86780240.

In JINR rapid communications. Collection.

A facility for studying characteristics of relativistic nuclear fragment interaction with a substance is described. The facility is based on a sectional detector-target comprising 40 Cherenkov counters with the 5.2 mm thick plexiglass radiators and the FEhU-84 type photomultipliers. The counters are located on the beam axis with the 6 mm step in the perpendicular plane they are developed as a fan with the step of 25.7 deg and period of 180 deg forming sensitive area 20 mm in diameter. The first counter determines charge composition of the beam. The changeable target permits to obtain data on dependence of the observed phenomenon on the substance of the target. The rest counters detect nucleus and fragment charges that makes it possible to determine the interaction vertex by change in their charge. Average charge resolution of one counter makes up 0.25 Oe, accuracy of interaction coordinate measurement is of the order of 0.3 cm. The SM-3 computer and the MULTI/ES program operating in real time scale are used for data acquisition control. The facility is utilized for study on the interactions of carbon, oxygen, neon and magnesium nuclei accelerated in the JINR synchrophasotron and their fragments with light (carbon, oxygen) and heavy (tungsten) nuclei of targets. The described facility ensures high efficiency of the investigated nucleus fragment separation and permits to determine probability of their production as well as medium free paths of nuclei and fragments. The used detectors are almost non-sensitive to slow and strong ionizing secondary products and they are low-sensitive to accompanying relativistic particles.

11834 (ISN—84-45) **Study and realization of a parallel plate avalanche counter used for time of flight and localization measurements.** Pellegrin, P.O. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 1985. 204p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE86750347.

A parallel Plates Avalanche Counter (P.P.A.C.) allowing high resolution training and localization is studied. It is designed to be placed on the beam trajectory-including the magnetic spectrometer of SARA accelerator at ISN Grenoble. Two purposes are searched: firstly to improve the time-of-flight measurement due to the very high intrinsic time resolution (it can be less than 150 ps), secondly to measure with accuracy the scattering angle of the particle on the target, due to its localization. The detector thickness has been reduced to set aside as unimportant the disturbance produced on the particle trajectory. The theoretical aspect of the detector operation and a quantitative study of the disturbances it causes on particle energy are presented. The set-up and its necessary surroundings are described with experimental results of its characteristics.

11835 (JINR-R—1-84-570) **Fast-response analog-to-digital processor for event selection by the difference in numbers of particles.** Kalinnikov, V.A.; Nikityuk, N.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701191.

The method of construction and the basic circuit of the analog-to-digital processor which is intended for event selection by the difference in numbers of particles passed through two hodoscope planes is described. The planes have 64 and 128 outputs, respectively. The delay time for processor signals does not exceed 55 ns. For economy and fast response increase the method of the data compression is used and combination of analog and digital micro circuits is applied. 4 references, 3 figures.

11836 (PNL-SA—13388) **Electrochemical development of particle tracks in CR-39 polymer dosimeter.** Hadlock, D.E.; Parkhurst, M.A.; Yang, C.S.; Groeger, J.; Johnson, J.R.; Huang, S.J. (Pacific Northwest Labs., Richland, WA (USA); Connecticut Univ., Storrs (USA). Inst. of Materials Science). Sep 1985. Contract AC06-76RL01830. 5p. (CONF-850933—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004879.

From 13. international conference on solid state nuclear track detectors; Rome, Italy (23 Sep 1985).

Electrochemical etching of CR-39 polymeric track etch neutron detectors results in proton-recoil tracks can be distinguished from background tracks much better than tracks developed solely by chemical etching. A newly designed and constructed electro-

chemical etching apparatus allows large numbers of dosimeters to be processed simultaneously with consistent results. Many processing systems have been developed for chemical and electrochemical etching of the track etch dosimeters. Three systems specifically show great promise and are being studied extensively.

11837 **(RAL—85-014) Design of the optical components and gas control systems of the CERN Omega Ring Imaging Cerenkov Detector.** Apsimon, R.J.; Cowell, J.; Flower, P.S. (Rutherford Appleton Lab., Chilton (UK)). Jun 1985. 51p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86701192.

A large Ring Imaging Cerenkov Detector (RICH) has been commissioned for use at the CERN Omega Spectrometer. The general design of the device is discussed, and the dependence of the attainable spatial resolution and range of particle identification on its optical parameters is illustrated. The construction and performance of the major optical components and gas systems of the detector are also described.

11838 **Portable neutron spectrometer and dosimeter.** Waechter, D. A.; Erkkila, B. H.; Vasilik, D. G. (to The United States of America represented by the United States Department of Energy, Washington, DC). US Patent 4,536,841. 20 Aug 1985. Filed date 8 Feb 1983. vp.

PAT-APPL-464841.

The disclosure relates to a battery operated neutron spectrometer/dosimeter utilizing a microprocessor, a built-in tissue equivalent LET neutron detector, and a 128-channel pulse height analyzer with integral liquid crystal display. The apparatus calculates doses and dose rates from neutrons incident on the detector and displays a spectrum of rad or rem as a function of keV per micron of equivalent tissue and also calculates and displays accumulated dose in millirads and millirem as well as neutron dose rates in millirads per hour and millirem per hour.

11839 **Heavy-ion identification using detector telescopes.** Goulding, F.S. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA). pp 227-274 of Treatise on heavy-ion science: Vol. 7. Instrumentation and techniques. Bromley, D.A. New York, NY; Plenum Press (1985).

This chapter examines identification methods that utilize the ionization signals produced when ions pass through one or more detectors. The signals contain amplitude and time information. The physical principles used in identifiers are emphasized. Topics considered include energy-loss methods, velocity measurements, algorithms, energy measurements, timing measurements, the resolution of particle identifiers, and experiments. The basic concepts for the simpler problem of light-ion identification are developed and expanded to deal with the complications of heavy-ion identification.

11840 **The Pajarito Monitor: a high-sensitivity monitoring system for highly enriched uranium.** Fehlau, P.E.; Coop, K.; Garcia, C.; Martinez, J. (Los Alamos National Laboratory, Los Alamos, NM). *Nuclear Materials Management;* **13**: 66-72(Jul 1984). (CONF-840734—).

From 25. annual meeting of the Institute of Nuclear Materials Management; Columbus, OH, USA (15 Jul 1984).

The Pajarito Monitor for Special Nuclear Material is a high-sensitivity gamma-ray monitoring system for detecting small quantities of highly enriched uranium transported by pedestrians or motor vehicles. The monitor consists of two components: a walk-through personnel monitor and a vehicle monitor. The personnel monitor has a plastic-scintillator detector portal, a microwave occupancy monitor, and a microprocessor control unit that measures the radiation intensity during background and monitoring periods to detect transient diversion signals. The vehicle monitor examines stationary motor vehicles while the vehicle's occupants pass through the personnel portal to exchange their badges. The vehicle monitor has four groups of large plastic scintillators that scan the vehicle from above and below. Its microprocessor control unit measures separate radiation intensities in each detector group. Vehicle occupancy is sensed by a highway traffic detection system. Each monitor's controller is responsible for detecting diversion as well as serving as a calibration and trouble-shooting aid. Diversion signals are detected by a sequential probability ratio hypothesis test that minimizes the monitoring time in the vehicle monitor and adapts itself well to variations in individual passage speed in the personnel monitor. Designed to be highly sensitive to diverted enriched uranium, the monitoring system also exhibits exceptional sensitivity for plutonium.

11841 **Physics with the crystal ball detector.** Bloom, E.D.; Peck, C.W. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA). *Annual Review of Nuclear and Particle Sciences;* **33**: 143-197(1983).

Although the people who studied photon detectors for e^+e^- storage rings at the 1974 PEP Summer Study did not know about the soon-to-bediscovered charmed quarks, subsequent events have shown that the practical realization of their ideas has borne rich rewards in understanding this sector of nature. The Crystal Ball detector grew out of that work and, as this brief review shows, it has proved to be an especially versatile instrument in spite of features (or lack of them) that at first sight would make it seem to be very specialized and restricted in application. Of course, the dominant strength of this detector has been, and always will be, the measurement of monochromatic photons, and it was this capability that allowed the Ball to resolve the old problems with the charmonium interpretation of psionic matter. However, the measurements of R / SUB h/ , for example, demonstrate the instrument's ability to determine global properties of e^+e^- annihilations. At the other extreme, kinematically constrained fitting to very specific final states that include just two charged particles but are rich in photons has been successfully exploited.

11842 **Underground science at Homestake.** Davis, R. Jr.; Cleveland, B.T.; Rowley, J.K. (Brookhaven National Lab., Upton, NY). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 2-15(1983). (CONF-820989—).

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

A brief overview is given of some of the scientific work that has been done in the Homestake mine. The problems and advantages of working in active mines are discussed. Some details on the construction of the chlorine solar neutrino experiment are presented and the current results of this experiment are given. The report concludes with a discussion of the importance and feasibility of a much larger chlorine experiment.

11843 **IMB detector - the first 30 days.** Bionta, R.M.; Blewitt, G.; Bratton, C.B.; Cortez, B.G.; Errede, S.; Foster, G.W.; Gajewski, W.; Goldhaber, M.; Greenberg, J.; Haines, T.J.; Jones, T.W. (Univ. of Michigan, Ann Arbor). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 138-142(1983). (CONF-820989—).

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

A large water Cherenkov detector, located 2000 feet below ground, has recently been turned on. The primary purpose of the device is to measure nucleon stability to limits 100 times better than previous measurements. The properties of the detector are described along with its operating characteristics.

11844 **Soudan nucleon decay experiments.** Price, L.E. (Argonne National Lab., IL). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 161-167(1983). (CONF-820989—).

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

Two nucleon decay experiments using the Soudan mine are discussed. Soudan 1 is currently taking data. It contains 31 tons, and is based on proportional tubes. It has set an upper limit of 1.0×10^{30} years on the lifetime of the nucleon. Soudan 2 is a proposal based on long drift chambers with an initial mass of 1000 tons, to be expanded to 5000 tons.

11845 **Proton decay and solar neutrino experiment with a liquid argon Time Projection Chamber.** Chen, H.H.; Doe, P.J.; Mahler, H.I. (Univ. of California, Irvine). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 182-185(1983). (CONF-820989—). Contract AT03-76ER71019.

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

Recent progress in development of the liquid argon Time Projection Chamber is reviewed. Application of this technique to a search for proton decay and ^{8}B solar neutrinos with directional sensitivity is considered. The steps necessary for a large scale application of this technique deep underground are described.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

11846 **(INIS-BR—375) Estimation of the measurement effective point in cylindrical ionization chamber used in electron beams with energies between 6 and 20 MeV.** Araujo, M.M. de. (Universidade Estadual de Campinas (Brazil). Inst. de Fisica). 1984. 132p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. File Number DE86780348.

The radial displacement was determined in a water phantom for electrons beams at energies from 6 to 20 MeV for three commercial cylindrical ionization chambers of internal diameters varying from 3.5 to 9.0 mm. The chambers were irradiated with the main axis perpendicular to the direction of the beam. A 300 V bias voltage was applied and readings were taken with both polarities. It was observed that, with increasing depth in the water phantom, the radial displacement remains constant for the 8.9 MeV beam, it increases for the 12.6 MeV electrons and decreases for those of 16.8 and 19.7 MeV. A theoretical model was built in order to calculate the displacement of the effective point of measurement. The Fermi-Eyges multiple scattering theory and a retangular beam normalism developed by Jette (1983) for therapeutic electron beam are used. It was found that the radial displacement stays constant with increasing depth and it decreases with increasing average energy of the incident beam. The model also predicts that the displacement is dependent on the chamber radius. The experimental and theoretical results are compared. They show good agreement for 8.9 and 12.6 MeV electrons, while for 16.8 and 19.7 MeV electrons they indicate that modifications in the theoretical model are necessary.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 10939, 11754, 11756, 11766, 11771, 11801

11847 (DOE/ER/10565—10, pp 67-72) **Microbeam studies.** Beug, M.U.D.; Divis, L.M.; Filpus-Luyckx, P.E.; Schweikert, E.A.; Summers, W.R. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

The objective of this project is to develop and evaluate ion induced desorption mass spectrometry for microscopic analysis. Briefly, the interaction of a microbeam (1-50μm diameter) of high energy heavy ions (84 MeV Kr^{+7}) with the target surface desorbs and ionizes atoms and molecules. The desorbed ions are analyzed via time-of-flight mass spectrometry to determine the composition of the area addressed with the microbeam. An account of recent work is summarized.

11848 **(DOE/ER/80010—T2) Birefringence relaxation for semiconductor minority-carrier lifetime measurement. Final report.** Sammells, A.F.; Ang, P.G.P.; Dempsey, P.F.; Schoonveld, L.H. (Eltron Research, Inc., Naperville, IL (USA)). Mar 1984. Contract AC02-83ER80010. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004484.

In order to eventually achieve high solar energy conversion efficiencies for photovoltaic cells, it will be necessary to use semiconductor materials with high optical absorption, low electron-hole recombination rates and long minority-carrier lifetimes. The work performed in this program was directed towards evaluating the viability of birefringence relaxation spectroscopy for the in situ measurement of minority-carrier lifetimes at semiconductor interfaces.

4404 Well Logging Instrumentation

11849 **(CEA-CONF—7879) Processing of gamma-ray spectrometric logs.** Umiastowski, K.; Dumesnil, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Oct 1984. 13p. (In French). (CONF-8410349—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750371.

From International colloquium on SAID-SPWLA logs; Paris, France (23 Oct 1984).

CEA (Commissariat a l'Energie Atomique) has developped a gamma-ray spectrometric tool, containing an analog-to-digital converter. This new tool permits to perform very precise uranium logs (natural gamma-ray spectrometry), neutron activation logs and litho-density logs (gamma-gamma spectrometric logs). Specific processing methods were developped to treate the particular problems of down-hole gamma-ray spectrometry. Extraction of the characteristic gamma-ray peak, even if they are superposed on the background radiation of very high intensity, is possible. This processing methode enables also to obtain geological informations contained in the continuous background of the spectrum. Computer programs are written in high level language for SIRIUS (VICTOR) and APOLLO computers. Exemples of uranium and neutron activation logs treatment are presented.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 11694, 11767

11850 **Fundamental research on explosives program.** Rivera, T. (Explosives Technology, MS C920, Los Alamos National Laboratory, Los Alamos, New Mexico). *Industrial and Engineering Chemistry, Product Research and Development;* **24**: No. 3, 440-442(Sep 1985).

The Fundamental Research on Explosives (FRE) program is a multidisciplinary, Laboratory-wide fundamental research effort whose aim is to gain a detailed molecular-level understanding of the energetics of liquid nitric oxide decomposition that supports the phenomenon of detonation in that system. In the FRE program we are interested in the details of the acquisition and maintenance of steady detonation in liquid nitric oxide and in how this steady condition compares to the existing (Chapman-Jouguet) theory of steady detonation.

11851 **Chemistry of (5-cyanotetrazolato-N^{2})pentaamminecobalt(III) perchlorate and similar explosive coordination compounds.** Lieberman, M.L. (Sandia National Laboratories, Albuquerque, New Mexico). *Industrial and Engineering Chemistry, Product Research and Development;* **24**: No. 3, 436-440(Sep 1985).

The coordination compound (5-cyanotetrazolato-N^{2})pentaamminecobalt(III) perchlorate has been developed for explosive applications. Chemical studies applying to this development are reviewed. These include establishment of a commercial synthetic procedure, determination of structure, characterization of impurities, and development of analytical techniques for chemical analysis. Chemical reaction paths leading to impurity formation and associated with thermal decomposition are examined. The status of an ongoing effort to define relationships between chemical structure and explosive properties is presented.

4502 Nuclear

REFER ALSO TO CITATION(S) 11918

11852 **(AD—349263/4/XAB) Ionization rate measurements.** LaRiviere, P.D.; Lee, H.; Larson, K.H. (Naval Radiological Defense Lab., San Francisco, CA (USA)). 1962. 184p. NTIS, PC A09/MF A01.

The basic objective of this project was to measure the variation with time of the air ionization dose rate (r/hr) and the cumulative air ionization dose (r) due to gamma radiation 3 feet above the ground in and about the fallout sector of the Small Boy event. The anticipated fallout sector was instrumented with 140 gamma intensity-versus-time recorders (GITR). High-range GITR's capable of registering up to 80,000 r/hr were used at close-in stations. Low-range GITR's capable of registering down to 1 mr/hr were used at remote stations. Support and back-up data were supplied by dosimeters and remote-reading radiacs, as well as gamma surveys and film dosimetry.

11853 **(AD-A—157808/7/XAB) Evaluation of alternative nuclear employment policy/technology. Executive summary - strategy, technology, and the threat. Technical report, 1 February-31 December 1982.** Wohlstetter, A. (R and D Associates, Marina del Rey, CA (USA)). 31 Dec 1982. 21p. NTIS, PC A02/MF A01.

This paper examines needed adaptations of our nuclear and nonnuclear strategy. In particular, it considers the impact of changes in the threat and changes in technology. Emphasis is placed on the increasing need for improved conventional capability.

11854 **(AD-A—158390/5/XAB) L/sub g/ wave excitation and propagation with application to nuclear yield determination. Final report 1 Apr 83-31 Mar 85.** Herrmann, R.B.; Wang, C.Y. (Saint Louis Univ., MO (USA). Dept. of Earth and Atmospheric Sciences). 28 May 1985. 77p. NTIS, PC A05/MF A01.

Malin's (1980) first-order single-scattering theory was extended to study the scattering of surface waves as well as body waves by distributed point scatterers in a layered medium. The scattered waveform itself is generated and examined instead of its energy envelope. The theory used allows: 1) mode conversion; 2) wave-type conversion; 3) finite-scatterer distribution; and 4) the effect of attenuation from scattering as well as intrinsic absorption. The cases studied are for elastic or slightly attenuative media with any kind of source and receiver at any place in the layered structure. This direct calculation of coda waves provides an immediate description of the relation of coda and scattering. The objectives are to find 1) the effect of layering on scattering; 2) the effect of scatterer distribution on recorded vertical and horizontal motion; 3) the relation of scattering Q to intrinsic Q; 4) the scattering behavior of surface and body waves; and 5) the superposition of scattering waves to form the coda. The generation of body waves by locked mode approximation, which makes the body wave a subset of the surface wave, is extensively studied.

11855 **(AD-P—004957/7/XAB) Calculation of lower confidence bounds on system reliability.** Michalowicz, J.V. (Harry Diamond Labs., Adelphi, MD (USA)). Feb 1985. 35p. NTIS, PC A03/MF A01.

A general methodology, based on algorithms developed by the Ad-Hoc Methodology Working Group on Nuclear Weapons Reliability Assessment, is described for evaluating 90% lower confidence bounds on system reliability for configurations of series/parallel circuits. General configurations of nonrepeated and repeated components are examined, and a method for unpooling data is discussed. A technique is derived for representing m-out-of-n decision-logic gates. The methodology is applied to an example of the type of a sophisticated weapon fuzing system. Maximum-likelihood estimates of reliability and 90% lower confidence bounds are calculated for the system, and critical components are identified.

11856 **(ORNL/Sub—84-89643/1) Study to simulate high altitude EMP surges induced in overhead power lines. Final report.** Smith, I.D.; Riepe, K.B.; Champney, P.D..; Corcoran, P.A.; Tesche, F.M. (Pulse Sciences, Inc., San Leandro, CA (USA)). Nov 1985. Contract AC05-84OR21400. 174p. (PSI-FR—191). NTIS, PC A08/MF A01; GPO Dep. File Number DE86004646.

The voltage waveforms induced on overhead power lines by high altitude EMP are calculated, varying the location and orientation of the power line with respect to the burst, the power line height, the ground conductivity, and the free field EMP amplitude and waveshape. Specifications are derived for a high voltage pulser that will simulate the effect of the power line on any object to which the power line is connected. A review is presented of the state-of-the-art of pulser technology that is appropriate for the simulator. A number of different design aproaches for the simulator are studied, using numerical circuit analysis and applying the capabilities of the technology previously reviewed. A number of ways are examined by which the simulator could be coupled to test objects energized with up to 500 kV ac. Finally, the design of the facility required to house the simulator and test object is briefly reviewed, along with ancillary equipment such as diagnostic and data recorders.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 10945, 10946, 11731, 11872, 11908

11857 **(DOE/ER/60149—1) Design and analysis of Cross-Appalachian Tracer Experiment (CAPTEX) field trials. Second annual progress report.** Baer, F.; Holland, J.Z. (Maryland Univ., College Park (USA). Dept. of Meteorology). 1985. Contract AS05-83ER60149. 72p. (SR—85-9). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004999.

Procedures for testing atmospheric transport and dispersion models for distances of several hundred to 1000 km from sources of pollutants are reviewed. The approach is to use both simulated tracer distributions and actual tracer measurements on the US-Canada multi-agency Cross-Appalachian Tracer Experiment CAPTEX '83 surface sampling domain to estimate the accuracy with which the parameters describing the location and distribution of the tracer cloud can be determined from experimental data. In CAPTEX '83, five perfluorocarbon tracer releases were made from Dayton, Ohio, and two releases from Sudbury, Ontario. Surface air samples were collected at 84 locations in northeastern United States and eastern Canada. Three simulation experiments have been conducted with a Gaussian plume model simulating time-integrated surface-layer concentration (i.e., dosage) distributions of tracer clouds from a surface source.

11858 **(DOE/ER/60304—1) Model validation research: comparison of simulated and observed climate patterns for the past 18,000 years. Progress report, February 1, 1985-January 31, 1986.** Webb, T. III. (Brown Univ., Providence, RI (USA). Dept. of Geological Sciences). Dec 1985. Contract FG02-85ER60304. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004631.

Research during 1985 was organized within four major tasks with a primary objective of testing the ability of the National Center for Atmospheric Research (NCAR) Community Climate Model (CCM) to simulate past climates. Because changes in the global mean temperature during the past 18,000 years have been similar in magnitude to those predicted for carbon dioxide doubling, the comparison of the model results with paleoclimatic data provides a useful test of the NCAR CCM, which is being used in carbon dioxide research. In particular, the data/model comparisons reveal certain of the model responses to past variations in the seasonal radiation budget. Key results included: (1) a description of a series of experiments with NCAR CCM to simulate climate for 18,000 y B.P. to present, (2) descriptions of available sea-surface temperature data from the tropics and of a global paleoclimatic data base for 6000 y B.P., (3) development of polynomial regression equations to estimate pollen percentages for temperature and precipitation data, and (4) favorable comparisons between paleoclimatic data and model results for the period 18,000 y B.P. in North America and for 18,000 B.P. to present in the Northern Hemisphere tropics. 40 refs., 5 figs.

11859 (DOE/ER/60351—T1) Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, 1 December 1984-30 November 1985. Blanton, J.O. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 17 Dec 1985. Contract FG09-85ER60351. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004391.

Several simulations were run of wind generated flow over undulating topography representing the actual topography found off the coast of Georgia. Sharp impulses of northward wind stress which cause instabilities in the frontal zone (caused by interaction of the wind generated current with the undulating topography) can transport low salinity water/initially within the frontal zone farther offshore and beyond the frontal zone. We have completed some numerical simulations off the Georgia continental shelf which take into account/gains and losses of buoyancy as well as wind-generated currents. The practical interpretation of results to date suggest that southward wind stress induce convective instabilities near the leading edge of the front and the front reforms closer to shore. The water volume in which inputs from shore is diluted is reduced under these circumstances.

11860 (DOE/EV/01340—15) Low-frequency variability in a climate model with a mixed-layer ocean. Gould-Stewart, S. (Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science). Nov 1984. Contract AC02-76EV01340. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004994.

A mixed-layer ocean model coupled to a global spectral atmospheric circulation model produces a warming in the model equatorial Pacific Ocean similar to the El Nino or Southern Oscillation (SO) response. The mechanism for producing the SO-like response in an ocean with heat storage and without ocean dynamics is investigated. The model is capable of simulating SO-like time scales, but the details of the structure of the warming differ significantly from the observed El Nino/Southern Oscillation (ENSO) response. 22 refs.

11861 (DOE/EV/01340—17) General circulation variability, medium to long-range forecasting, and energy industry related applications. Final report, 1 January 1983-31 December 1985. Reiter, E.R. (Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science). Dec 1985. Contract AC02-76EV01340. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004819.

Progress is reported on: establishment of a data base of Sea Surface Temperatures (SST) in North Atlantic and North Pacific and of atmospheric data at constant pressure levels; diagnostic planetary wave patterns on prolonged weather and/or short-term climate anomalies;numerical modeling experiments, involving the application of a simple General Circulation Model (GCM) to an assessment of climate-controlling teleconnections; long-range forecasting tests, involving teleconnections between surface anomalies and planetary wave pattern anomalies; forecast risk assessments, estimating the confidence level to be placed on a long-range forecast; energy-industry related forecasting applications, such as estimates of electric power demands; and user-friendly forecast output design which would allow easy dissemination of forecast products.

11862 (DOE/EV/01340—T4) Global low order spectral model designed for climate sensitivity studies. Hanna, A.F.; Stevens, D.E. (Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science). Mar 1984. Contract AC02-76EV01340. 60p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004992.

Atmospheric Science Paper No. 378.

A two-level, global, spectral model using pressure as a vertical coordinate is developed. The system of equations describing the model is nonlinear and quasi-geostrophic (linear balance) (Lorenz, 1960). A moisture budget is calculated in the lower layer only with moist convective adjustment between the two layers. The mechanical forcing of topography is introduced as a lower boundary vertical velocity. Solar forcing is specified assuming a daily mean zenith angle. On land and sea ice surfaces a steady state thermal energy equation is solved to calculate the surface temperature. Over the oceans the sea surface temperatures are prescribed from the climatological average of January. The model is integrated to simulate the January climate. 35 refs., 2 figs., 1 tab.

11863 (DOE/EV/01340—T5) Associations between summer circulation anomalies and sea surface temperature forcing. Bossert, J.E. (Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science). Apr 1985. Contract AC02-76EV01340. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004993.

Environmental Research Papers No. 41; Thesis.

Observational studies have associated a 3-cell pattern of anomalous 700 mb anticyclones with drought. These three strong anticyclones are located over the eastern North Pacific, the central United States, and the eastern North Atlantic. The present study utilizes a two-level global spectral model to test the hypothesis that sea surface temperature anomaly (SSTA) forcing is initiating the 3-cell, drought-producing anticyclone pattern. It is proposed that the two anomalous oceanic anticyclones develop over the barotropic eastern ocean basins in response to abnormally cold surface water in this region, as observed in June of 1980. Teleconnection patterns for summer reveal the tendency for a similar anomalous anticyclone to develop over the central United States once the oceanic anomaly has formed. Based on this empirical evidence, the initial experiments investigate the association between SSTA forcing and anomalous drought-producing circulations. Additional experiments are undertaken to examine the effects of changes in the magnitude and latitude of the SSTAs on the model response, and to investigate the possibility of an interhemispheric energy transfer within the model integration. The magnitude and location of the SSTA greatly influences the resultant model response, demonstrating the atmosphere's sensitivity to this type of forcing. The large interhemispheric response discovered in the model is attributed to the difficulties in the simulation of the tropical wind field, which allows for the transfer of meridionally propagating energy between the Northern and Southern Hemispheres through westerly wind ducts. 34 refs.

11864 (DP-MS—85-105) Atlantic Coast Unique Regional Atmospheric Tracer Experiment (ACURATE). Schubert, J.F.; Heffter, J.L.; Mead, G.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; National Oceanic and Atmospheric Administration, Rockville, MD (USA). Air Resources Labs.; BOC Group, Murray Hill, NJ (USA). Technical Center). 1985. Contract AC09-76SR00001. 67p. (CONF-851235—1). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004614.

From American Geophysical Union fall meeting; San Francisco, CA, USA (9 Dec 1985).

A long-range, long-term data set on the regional scale for air pollution model was developed for evaluation. The ACURATE model used Kr-85 emitted intermittently from the Savannah River Plant as a tracer of hourly source emission data at 5 sites for a total of 3858 measurements.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 10788, 10807, 10812, 10875, 10879, 10880, 10886, 10887, 10888, 10922, 10924, 11206, 11632, 11657, 11782, 11895, 12009, 12026

11865 (CONF-841202—4) Formaldehyde emissions from fibrous glass insulation products. Matthews, T.G.; Westley, R.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004810.

From Symposium on thermal insulation, materials and systems; Dallas, TX, USA (2 Dec 1984).

The formaldehyde (CH_2O) emission potential of fibrous glass insulation acquired from the three largest US manufacturers has been investigated. Screening measurements of unfaced and kraft-faced R-19, foil-faced R-11, and one inch unfaced insulation made with a formaldehyde surface emission monitor (FSEM) demonstrate low inter-product and inter-manufacturer variation in CH_2O emission rates. The FSEM screening data and environmental chamber measurements of unfaced R-19 insulation taken at 23°C and 50% relative humidity (RH) both indicate CH_2O emission rates of 0.02

+- 0.01 mg/m^{3}h after one to three months of product conditioning in low CH_2O concentration atmospheres. Threefold to fourfold increases in CH_2O emissions were measured in environmental chamber tests taken at 38°C and 68% RH, conditions simulating potential seasonal exposures in attic and wall cavities adjacent to indoor compartments. However, a two-compartment model describing the potential impact of attic insulation at 38°C and 68% RH on indoor CH_2O concentrations indicates a maximum increment of only 0.02 ppM.

11866 **(DP-MS—85-116) Gas exchange between the forest and the atmosphere.** Murphy, C.E. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1985. Contract AC09-76SR00001. 36p. (CONF-8510250—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE86004624.

From Department of Energy (DOE) meterology workshop; Lake Placid, NY, USA (1 Oct 1985).

Forest gas exchange is discussed in terms of the processes that control the rate of exchange with the atmosphere. Examples are presented to show how vegetative uptake control is varied for gases with different characteristics. The prediction of uptake for large areas and over long periods of time is discussed in terms of quantitative models of the gas exchange processes. Finally, remote sensing is suggested as a means of obtaining the parameters needed to make the model predictions. 46 refs., 6 figs.

11867 **(ORNL/CDIC—11) Carbon Dioxide Information Center FY 1985 progress report.** Farrell, M.P. (Oak Ridge National Lab., TN (USA)). Nov 1985. Contract AC05-84OR21400. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004654.

The Carbon Dioxide Information Center (CDIC) has eight major functions: (1) distribute DOE and CDIC publications; (2) publish a CO_2 document, CDIC communications; (3) respond to information requests; (4) develop a bibliographic information system and provide searching capabilities; (5) identify the CO_2 research community and policymakers and provide access to a computerized world directory; (6) evaluate and test computer codes and package the models; (7) compile and evaluate numeric data bases and package the data; and (8) provide networking facilities among other data centers. This report summarizes CDIC progress during FY 1985 in these functions. (ACR)

11868 **(ORNL/TM—9100) Modeling and testing of formaldehyde emission characteristics of pressed-wood products. Reports XII, XIII, and XIV to the US Consumer Product Safety Commission, 1985.** Matthews, T.G. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86005258.

A survey of the CH_2O emissions from pressed-wood products was conducted by selecting random samples of particleboard, hardwood plywood paneling, and medium density fiberboard from the largest US manufacturers and measuring their emissions using the formaldehyde surface emission monitor (FSEM). The product sampling protocols, results of the FSEM measurements, and statistical modeling of the intra-board, inter-board, and inter-product variation in CH_2O emission strength are discussed in Reports XII and XIII. A second project concerns the CH_2O permeability of common decorative floor coverings that can influence the CH_2O emissions from particleboard underlayment in homes. The test design and preliminary experimental results for CH_2O transport coefficient measurements of these flooring materials are presented in Reports XIII and XIV. A third project concerns an inter-laboratory test comparison of the FSEM. The first phase of this project, consisting of an inter-laboratory test comparison of the CH_2O analysis of uniformly exposed 13X molecular sieve samples, is presented in Report XIII. A fourth project concerns the experimental measurement and modeling of the temperature, relative humidity, and CH_2O concentration dependence of CH_2O emissions from particleboard and hardwood paneling products. A preliminary report of the environmental chamber data for the first of two environmental parameters studies is given in Report XIV. Preliminary models are developed from a physical theory of CH_2O transport across the bulk-vapor interface at the surface of pressed-wood products to describe the CH_2O environmental parameters data.

11869 **(ORNL/TM—9706) Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests.** Johnson, D.W. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86005345.

A comparison was made of the effects of acid deposition, natural leaching, and harvesting on base cation export from coniferous forests in Maine, coniferous and deciduous forests in Tennessee, a coniferous forest in South Carolina, a deciduous forest in North Carolina, and coniferous and deciduous forests in Washington. Sulfate dominated leaching in the Tennessee sites, whereas HCO_3^- dominated leaching in the Maine, North Carolina, South Carolina, and Washington sites. Nitrate leaching was negligible in all but a red alder site in Washington where nitrogen fixation resulted in net NO_3^- leaching. Total base cation export by leaching exceeded $Ca^{2+} + Mg^{2+} + K^+$ export that results from whole-tree harvesting in most sites. However, leaching, even as augmented by acid deposition, does not appear to pose an imminent threat to soil base cation supplies on sites for which soil data are available. This is basically because soil base cation reserves are very large relative to leaching rates. Some sites showed a net Ca^{2+} or K^+ accumulation from atmospheric deposition until they were subjected to whole-tree harvesting. Thus, leaching need not cause a net export of all nutrient cations, even if total base cation export is accelerated by acid deposition.

11870 **(PB—85-236099/XAB) Metabolic activation pathways of cyclopenta-fused PAH (polycyclic aromatic hydrocarbons) and their relationship to genetic and carcinogenic activity.** Nesnow, S.; Gold, A.; Mohapatra, N.; Sangaiah, R.; Bryant, B.J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Aug 1985. 12p. (EPA/600—D-85/161). NTIS, PC A02/MF A01.

Cyclopenta-fused PAH are a novel class of environmental PAH of which the most well known example is cyclopenta(cd)pyrene. The fusion of an unsaturated cyclopenta-ring on a PAH in general, markedly enhances its activity as a gene mutagen in bacteria and cultured mammalian cells, a cell transforming agent in rodent cells and a mouse skin tumor initiator. A series of four cyclopenta-fused isomers of benz(a)anthracene and the cyclopenta-fused isomers of anthracene and phenanthrene were studied with respect to the major rat liver microsomal metabolites, their activity as gene mutagens in Salmonella typhimurium and Chinese hamster V79 cells and their ability to morphologically transform C3H10T1/2CL8 mouse embryo fibroblasts. For all six isomers, the dihydrodiol arising from oxidation and hydration at the cyclopenta-ring was a major pathway in Aroclor-1254 induced rat liver microsomes. All six isomers were active in mutating Salmonella typhimurium and the four benz(a)anthracene isomers active in mutating V79 cells at the HGPRT locus.

11871 **(PB—85-237857/XAB) Surrogate experimental models for studying particle deposition in the human respiratory tract.** Martonen, T.B. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Aug 1985. 60p. (EPA/600—D-85/158). NTIS, PC A04/MF A01.

Hazard assessment following challenge by ambient aerosols requires accurate estimation of exposure, that is, determination of the total mass of particulate matter deposited within the respiratory tract, and its intercompartmental distribution. Aerosol deposition studies utilizing human test subjects yield valuable information on the deposition of inhaled particles in man, but experimental regimens lack the resolution to quantitate hot spots within the lung. Aerosol deposition experiments with respiratory tract surrogates, or models, can be designed to be complementary to human studies. The authors have put experimental modeling efforts into perspective per their applicability for the risk assessment of inhaled ambient aerosols. Heterogeneity of deposition has been detected in in vitro experiments over a wide range of particulate sizes and flow rate magnitudes - in a variety of surrogate larynx-TB models, for both constant and time-dependent flow patterns, and for both phases (inspiration and expiration) of a breathing cycle.

11872 **(PNL-SA—13028) Comparison of a multilayer regional-scale acid rain assessment model (MLRAPT) with a single-layer assessment model, RAPT.** Davis, W.E.; Glantz, C.S. (Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. Contract AC06-76RL01830. 24p. (CONF-850944—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004862.

From Muskoka conference: international symposium on acidic precipitation; Toronto, Ontario, Canada (15 Sep 1985).

Uncertainty due to treating transport processes using a single-layer model compared to a multilayer model was examined. MLRAPT uses isentropic layers to characterize advection of SO_2 and $SO^{2-}{}_4$ in either a multilayer mode, where both horizontal and vertical transport are calculated, or a single-layer mode, where only horizontal transport is considered. Comparison between the two modes indicated that the average air concentrations were highly correlated (a correlation coefficient of 0.95). However, for wet deposition of $SO^{2-}{}_4$, a correlation coefficient of 0.55 between the two predicted wet deposition fields was obtained. Results of the comparison of the two modes, the observed air concentration fields, and limited comparison of observed and predicted wet deposition have implications on using a single-layer model to develop source/receptor relationships. 9 refs., 11 figs.

11873 **Indoor air quality: sources and control.** Sextro, R.G.; Nero, A.V.; Grimsrud, D.T. (Lawrence Berkeley Lab., CA). *AIP (American Institute of Physics) Conference Proceedings;* No. 135, 299-246(1985). (CONF-850414—). Contract AC03-76SF00098.

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

The nature of the indoor air quality problem is described; methods of control or reduction of indoor radon and radon progeny concentrations have been reviewed. These techniques may be categorized as radon source reduction, radon removal, and radon progeny removal. There are a number of potential sources of radon in US housing, including soil, potable water, and building materials. In most cases, it appears that flow of radon-bearing soil gas into houses, driven by a slight negative pressure differential across the building shell, is a major source of indoor radon; this pressure-driven flow appears to be the most likely source of radon that can account for the elevated radon concentrations observed in some houses. There are a number of radon source control techniques; their effectiveness will depend upon characteristics of the house substructure and the details of the specific application. While the results of such remedial measures have varied and the data base from which to generalize is small, five-to-ten-fold reductions in radon concentration have been reported. 31 references, 4 figures.

11874 **Meteorological fundamentals for air pollution studies.** pp 17-37 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

Some of the more important meteorological factors directly related to air pollution are described. In addition, the quantitative methods for evaluating the behavior of contaminants introduced into the atmosphere are discussed. These methods require that certain properties of the atmosphere be measured. Given the numerical values to substitute into the equations, solutions of the equations can provide diffusion estimates. The meteorological fundamentals which are required to cope with the various problems which will be encountered are discussed. They include: transport, trajectories, effects of obstructions and channeling, deformations, winds, surface friction, mixing processes, temperature profiles, turbulence, conductivity and specific heat, and phase change of surface water. 23 references, 29 figures, 1 table.

11875 **Outline of atmospheric diffusion theories.** pp 38-58 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

An outline of the significant practical results of the various meteorological diffusion theories are attempted. Since there is no general agreement on a best theory and since several approaches are currently available, the comparative advantages and shortcomings of each are discussed. No exhaustive treatment is, however, possible here. Rather, an attempt is made to collect and present concisely, and in a logical way, the results that appear to be germane to those problems of greatest interest to the atomic energy industry. It has not been possible to do justice to all phases of the diffusion problem, with its multiplicity of approaches and many ramifications. In particular, emphasis has been placed on the presentation of final results, with references serving instead of proofs.

11876 **Behavior of stack effluents.** pp 59-75 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

It has been found that the appearance of effluent plumes from stacks is regulated largely by the vertical gradient of air density (as measured by the vertical gradient of air temperature) in the neighborhood of a stack. Since there are a limited number of configurations of the vertical temperature gradient that are likely to occur in nature, the kinds of plume behavior likely to be observed from any particular stack are also limited. Although some variations may be found, it is believed that there are five major types of plume behavior, and these are discussed in detail. 17 figures, 2 tables.

11877 **Fall-out, wash-out, and rain-out from airborne clouds.** pp 88-98 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

Although fall-out, wash-out, and rain-out are features of the behavior of airborne clouds, the treatment of these phenomena requires consideration of factors not common to uninfluenced diffusion. Deposition of material from an explosion cloud or a stack plume is conveniently divided into dry weather and precipitating weather conditions, with subdivisions for gaseous products and particulate products. Sutton's equation for diffusion can be modified to take into account the effects of deposition during precipitating and nonprecipitating conditions. Fall-out is used to designate deposition during nonprecipitating weather and includes the effects of both gravitational settling and impaction. Wash-out is used to designate removal of material from the air due to capture by falling precipitation elements. Rain-out and wash-out have sometimes been used interchangeably in the literature, but in this publication rain-out is defined as removal due to association of the particulate element or gaseous matter with the precipitation element prior to its descent. The wash-out process, which is of greater interest industrially, is applicable to airborne matter entirely below the bases of precipitating clouds.

11878 **Graphical solutions to atmospheric diffusion problems.** pp 111-121 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

Because of the values that the variables and parameters assume, numerical evaluations of diffusion equations are fairly tedious. Furthermore, since in most cases the use of tables of logarithms cannot be avoided, direct numerical calculations will ordinarily produce a degree of accuracy far greater than that warranted by the diffusion theories themselves. Graphical aids would seem, consequently, to be particularly desirable in diffusion calculations. Graphs for the evaluation of functions of the basic form of those derived from the Gaussian law have been given by Frenkiel and Jahnke and Emde. Davidson gives a very useful set of nomograms covering some of Calder's results; and some nomographic presentations of Bosanquet and Pearson's continuous point source formula can be found in Falk et al. Sutton refers to a slide rule invented by Davies which solves the Sutton equation for certain discrete combinations of the meteorological parameters. An attempt is made to give solutions to basic diffusion equations and also to treat many useful modifications. A wide range of variables and parameters is allowable. 7 figures, 1 table.

11879 **Meteorological equipment and records.** pp 126-146 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

The meteorological equipment and techniques of particular interest in connection with atomic energy are those necessary to obtain data pertinent to atmospheric diffusion. A more detailed representation of the three dimensional structure of the atmosphere is required for this purpose than is needed for ordinary engineering purposes. Special equipment found at the larger atomic energy sites includes micro-net stations for additional surface observations of

wind temperature and rainfall, meteorological tower facilities for continuous temperature and wind gradient information up to at least as high as the top of the plant stacks, and temperature and wind sounding equipment for periodically reaching levels above the top of the towers. At sites where meteorological research is conducted, special instruments for studying atmospheric turbulence are also in use. Special meteorological records and methods of data tabulation are also necessary at sites where diffusion estimates are required. Many of the necessary parameters (wind direction deviation, temperature gradient, etc.) are not now commonly measured at the usual meteorological installation. The multiplicity of parameters and the necessity for several meteorological stations at a single site can lead to an amazing amount of raw data. Only by orderly tabulation and proper summarization can this information be reduced to a meaningful and digestible form. Some of the special meteorological record forms and summaries which have proved useful in the preparation of diffusion climatologies are included.

11880 **Climatological data for site selection and planning.** pp 147-157 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

Prior to the construction and operation of atomic energy plants, climatic data may be required for site selection, planning, and plant design. The data are collected and analyzed in a survey report in such a manner that they will provide information useful for stack gas diffusion estimates and engineering and construction needs. An outline suggesting information to be included in the survey is given in this study. This is followed by a listing of sources of climatic data. 152 references, 1 figure.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11278, 11864, 11866, 11873

11881 **(DOE/ER/60005—T2) Progress in indoor radon measurement. Review of previous research (July 1981-February 1985).** (Pittsburgh Univ., PA (USA)). 1985. Contract AC02-81ER60005. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004408.

Research progress in the following areas is reported: (1) scintillation cell development and applications, (2) charcoal adsorption development and applications; (3) surveys with Terradex detectors; (4) radon carcinogenesis epidemiology; (5) large scale surveys of radon concentrations in randomly selected houses; (6) ventilation rate studies; (7) soil studies; (8) diffusion of radon through materials other than soil; and (9) test house studies. (ACR)

11882 **(DOE/ER/60186—6) Study of the atmospheric chemistry of /sup 218/Po. Final report, August 21, 1983-December 31, 1985.** Hopke, P.K. (Illinois Univ., Urbana (USA). Inst. for Environmental Studies). Dec 1985. Contract AC02-83ER60186. 58p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86005115.

It was demonstrated that there are two mechanisms for the neutralization of $^{218}Po^{+}$ ions formed by the decay of ^{222}Rn in addition to simple ionic recombination. In the presence of oxygen, an oxide species is formed. It has been determined that this oxide species has an ionization potential in the range of 10.35 to 10.53 eV and that it can be neutralized by extracting electrons from lower ionization potential trace gases. It has also been found that a second mechanism is responsible for neutralization in the absence of oxygen. The behavior of NO_2 in the range of 50 ppB to 1 ppM in N_2 was explored. For NO_2 concentrations above 700 ppB, complete neutralization was observed. For lower concentrations, a concentration dependent degree of neutralization was observed. Studies have been initiated on the kinetics of these neutralization mechanisms. A system for continuously monitoring the airborne ^{218}Po concentration under controlled gas composition and electric field conditions has been designed, constructed, and tested. The initial studies with this system have been on the neutralization by NO_2 in nitrogen mechanism that had been attributed to an electron scavenging mechanism. Excellent agreement with the previous measurements was obtained for the NO_2 concentration dependence of the diffusion coefficient of ^{218}Po. 57 refs., 7 figs., 7 tabs.

11883 **(PB—85-239267/XAB) Environmental Radiation Data report 29: January-March 1982.** Petko, C.; Mardis, H.M.; Battist, L. (Office of Radiation Programs, Washington, DC (USA)). Jun 1982. 91p. (EPA/520/5—83/005). NTIS, PC A05/MF A01.

The quarterly report contains data from the Environmental Radiation Ambient Monitoring System (ERAMS), and similar networks operated by contributing State, Canada, Mexico, and the Pan American Health Organization are reported in (ERD) when available. The ERAMS is comprised of nationwide sampling station that provide air, surface, and drinking water and milk samples from which environmental radiation levels are derived. The radiation analyses performed on these samples include gross alpha and gross beta levels, gamma analyses for fisson products, and specific analyses for uranium, plutonium, strontium, iodine, radium, krypton, and trituim.

11884 **(PB—85-239275/XAB) Environmental Radiation Data report 28: October-December 1981.** Mardis, M.; Petko, C.; Battist, L. (Office of Radiation Programs, Washington, DC (USA)). Mar 1982. 109p. (EPA/520/1—83-002). NTIS, PC A06/MF A01.

Environmental Radiation Data are compiled and distributed quarterly by the Office of Radiation Programs Eastern Environmental Radiation Facility, Montgomery, Alabama. Sampling locations are selected to provide optimal population coverage while functioning to monitor fallout from nuclear device and other forms of radioactive contamination of the environment. The radiation analyses performed on these samples include gross alpha and gross beta levels, gamma analyses for fission products, and specific analyses for uranium, plutonium, strontium, iodine, radium, krypton, and tritium. This monitoring effort also serves to provide ancillary information on releases into the environment from stationary sources such as nuclear power reactors, fuel fabrication and reprocessing plants and natural background levels.

11885 **(PB—85-242295/XAB) Environmental Radiation Data report 30, April-June 1982. Quarterly report.** Petko, C.M.; Mardis, H.M.; Battist, L. (Office of Radiation Programs, Washington, DC (USA)). Sep 1982. 102p. (EPA/520/5—6-83/006). NTIS, PC A06/MF A01.

The quarterly report contains data from the Environmental Radiation Ambient Monitoring System (ERAMS), and similar networks operated by contributing States, Canada, Mexico, and the Pan American Health Organization are reported in (ERD) when available. The ERAMS is comprised of nationwide sampling stations that provide air, surface, and drinking water and milk samples from which environmental radiation levels are derived. The radiation analyses performed on these samples include gross alpha and gross beta levels, gamma analyses for fission products and specific analyses for uranium, plutonium, strontium, iodine, radium, krypton and tritium.

11886 **(UCRL—93415) Contour-to-grid methods for the ARAC system.** Barbieri, J.F. (Lawrence Livermore National Lab., CA (USA)). Dec 1985. Contract W-7405-ENG-48. 15p. (CONF-851252—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004919.

From Geographic information systems in the government workshop; Springfield, VA, USA (10 Dec 1985).

By combining a digitizing system with a contour-to-grid program, digital elevation data may be developed from contour maps automatically for any existing contour map.

11887 **Meteorology and atomic energy.** Washington, DC; Atomic Energy Commission ([1986]). 177p.

The science of meteorology is useful in providing information that will be of assistance in the choice of favorable plant locations and in the evaluation of significant relations between meteorology and the design, construction, and operation of plant and facilities, especially those from which radioactive or toxic products could be released to the atmosphere. Under a continuing contract with the Atomic Energy Commission, the Weather Bureau has carried out this study. Some of the meteorological techniques that are available are summarized, and their applications to the possible at-

mospheric pollution deriving from the use of atomic energy are described. Methods and suggestions for the collection, analysis, and use of meteorological data are presented. Separate abstracts are included of 12 chapters in this publication for inclusion in the Energy Data Base.

11888 **Air pollution aspects of the atomic energy industry.** pp 1-12 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

Meteorology is important to the atomic energy industry for engineering and operational applications common to industry generally, but, in particular, it is important because of its usefulness when dealing with radioactivity in the atmosphere. Meteorology must be used in estimating environmental exposure risks if radioactivity is released through tall stacks and laboratory type vents as part of a routine waste disposal procedure or when it is necessary to consider accidental releases under a variety of circumstances. An outstanding use of meteorology is in the estimation of the spread of contaminants from a reactor disaster. The nature of radioactive materials and their sources are discussed. 7 figures.

11889 **Meteorology in site operations.** pp 13-16 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

During the site selection and design phases of a plant, meteorological assistance must be based on past records, usually accumulated at stations not actually on the site. These preliminary @advices will be averages and extremes that might be expected. After a location has been chosen and work has begun, current and forecast weather conditions become of immediate concern. On-site meteorological observations and forecasts have many applications to the operating program of an atomic energy site. Requirements may range from observations of the daily minimum temperatures to forecasts of radiation dosages from airborne clouds.

11890 **Behavior of explosion debris clouds.** pp 76-87 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

In the normal course of events the behavior of debris clouds created by explosions will be of little concern to the atomic energy industry. However, two situations, one of them actual and one postulated, exist where the rise and spread of explosion clouds can affect site operations. The actual occurrence would be the detonation of nuclear weapons and the resultant release and transport of radioactive debris across the various atomic energy installations. Although the activity of the diffusing cloud is not of biological concern, it may still be sufficiently above background to play havoc with the normal readings of sensitive monitoring instruments. If it were not known that these anomalous readings resulted from explosion debris, considerable time and expense might be required for on-site testing and tracing. Fortunately it is usually possible, with the use of meteorological data and forecasts, to predict when individual sites are affected by nuclear weapon debris effects. The formation rise, and diffusion of weapon clouds will be discussed. The explosion of an atomic reactor is the postulated situation. It is common practice in reactor hazard analysis to assume a combination of circumstances which might result in a nuclear incident with a release of material to the atmosphere. It is not within the scope of this report to examine the manifold plausibilities that might lead to an explosion or the possible methods of release of gaseous and/or particulates from such an occurrence. However, if the information of a cloud is assumed and some idea of its energy content is obtainable, estimates of the cloud behavior in the atmosphere can be made.

11891 **Radioactive cloud dosage calculations.** pp 99-110 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

A cloud of radioactive material released instantaneously into the atmosphere, spreading under the action of turbulent eddies and possibly subject to settling or to wash-out by precipitation, could irradiate people downwind. Alpha, beta, or gamma radiation might be involved. However, most routine process wastes or accidentally released fission products would be primarily beta or gamma emitters. Furthermore the range of influence of alpha emitters is in general so small and their half lives are so long that they can be treated in nearly all respects by the same computation methods as would be applied to nonradioactive toxic agents. Therefore the present discussion will be limited to beta and gamma emitters. External beta radiation is received only from emitters located within a few meters of the receptor owing to the short range of beta particles in air. In clouds of the dimensions of several meters or greater, therefore, the external beta dose rate is proportional to the local concentration of beta emitting atoms within the accuracy of the prediction, or measurement, of the concentration. Gamma radiation on the other hand has a mean free path in air of the order of 100 meters. In order to calculate the gamma dose rate, it is therefore necessary to integrate the radiation from a volume which may be comparable to, or greater than, the dimensions of the cloud. In both cases the total dosage is calculated by integrating the dose rate with respect to time.

11892 **Reactor hazard analyses.** pp 122-125 of Meteorology and atomic energy. Washington, DC; Atomic Energy Commission ([1986]).

Included in this study is a listing of meteorological items pertinent to a release of airborne radioactivity which should be considered for possible inclusion in a complete reactor hazard analysis. Not all reactor hazard analyses would, or should, contain all the elements listed. The type of reactor, its design power level, the site locations, etc., must be considered in fixing the scope of a hazard analysis. Only a first presentation of a very high power reactor would require consideration and treatment of all items. Analyses for reactors at a site for which previous reports have been prepared may well refer to these reports for climatology, site description, etc., and deal only with items or hazards unique to the device under consideration. Standard computational techniques for radiation estimates can eliminate repetition of derivations and basic meteorological data. The items listed in the outline should not be considered separately but rather should be integrated to whatever extent is necessary into the entire hazard analysis. Obviously, a health physicist and a reactor engineer will have to provide much of the required information.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 10810, 11162

11893 **(CONF-8505223—1) Linkages in hierarchical models.** Urban, D.L.; O'Neill, R.V.; Shugart, H.H. (Oak Ridge National Lab., TN (USA); Virginia Univ., Charlottesville (USA)). 1985. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004794.

From Coupling of ecological studies workshop; Athens, GA, USA (15 May 1985).

A brief overview of hierarchy theory as applied to terrestrial landscapes is provided. An approach to modeling landscapes so as to generate large-scale patterns from lower-level processes is outlined. It is suggested a hierarchical model may be the vehicle by which the "bottom-up" and "top-down" approaches to landscapes can be reconciled. 15 refs., 2 figs. (ACR)

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 10811, 10949, 11632, 11869, 11914

11894 **(DOE/ER—0252) Anaerobic biogeochemical processes in the subsurface. Subsurface transport program, interactive seminar series.** Bollag, J.M.; Wobber, F.J. (Pennsylvania State Univ., University Park (USA). Soil Microbiology Lab.; USDOE Office of Energy Research, Washington, DC). 1985. 45p. (CONF-850521—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004279.

From Anaerobic biogeochemical processes in subsurface transport - an interactive seminar; University Park, PA, USA (14 May 1985).

The seminar was organized to review the current state of knowledge of microbial anaerobic processes involved in the transformation and transport of organic and organometallic contaminants in the subsurface environment and to identify future research needs. This report summarizes the presentations and discussions. (ACR)

11895 (EUR—5004-DEF, pp 189-197) **Lead as an environmental pollutant.** Rameau, J.T.L.B. (Bedriifslaboratorium voor Grond- en Gewasonderzoek, Oosterbeek, Netherlands). May 1973. Commission of the European Communities, Luxembourg. (CONF-721094—).

From International symposium on the environmental health aspects of lead; Amsterdam, Netherlands (2 Oct 1972).

The contamination of plants and soil by lead from tetraethyl lead in gasoline is reviewed. Leafy vegetables should not be grown near roads. Lead content of roadside grass in the Netherlands is not yet high enough to cause Pb poisoning in cattle, but it is not recommended that they be fed this grass. Measurements of Pb in roadside plants, roadside soils, and normal plants are listed. The sampling and analytical methods for Pb must be carefully chosen to make them comparable. Wide discrepancies between different laboratory methods point up the need for comparability studies. 26 references, 3 tables.

11896 **(PB—85-236495/XAB) Effects of acid precipitation on a typical quartzipsamment soil in Florida.** Volk, B.G.; Byers, G.E. (Florida Univ., Gainesville (USA). Dept. of Soil Science). Aug 1985. 22p. NTIS, PC A02/MF A01.

The magnitude of leaching of nutrients from the soil surface to the water table and to a nearby drainage system depends on many factors unique to the site. The sensitive deep sands of Florida present an extreme case of low-nutrient status and high water flux to great depth. In addition, water-table characteristics, both physical and chemical, influence the horizontal flow vis-a-vis the vertical flows. The magnitude of leaching also depends on the nature of the ion, the depth being considered, and the acid treatment. Readsorption of ions in the soil profile was shown to occur which further complicates the overall assessment of the real effect of acid rain. The effect of acid rain is not long lasting and the soils recover the normal soil leachate chemistry within 48 hours.

11897 **Multiphase approach to the modeling of porous media contamination by organic compounds. I. Equation development.** Abriola, L.M.; Pinder, G.F. (Michigan Univ., Ann Arbor). *Water Resources Research;* **21**: No. 1, 11-18(Jan 1985). Contract AC02-79EV10257.

The infiltration and migration of a chemical contaminant in the subsurface is a complex process. A multiphase approach to the modeling of organic compound migration in the subsurface is presented. This comprehensive approach makes it possible to describe the simultaneous transport of a chemical contaminant in three physical forms: as a nonaqueous phase, as a soluble component of a water phase, and as a mobile fraction of a gas phase. Using volume-averaging theory, equations governing such migration were developed from basic conservation of mass principles for a two-component contaminating phase. Incorporated within these equations are the effects of matrix and fluid compressibility, gravity phase composition, interphase mass exchange, capillarity, diffusion, and dispersion. The resulting equations form a system of three nonlinear partial differential equations in five unknowns, two capillary pressures and three mass fractions. On the basis of the concept of local equilibrium between the phases, two constraints relating mass fractions were formulated to close this mathematical system. 34 references, 2 figures.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11000, 11057, 11082, 11883, 11884, 11885

11898 **(ARL/TR—070) Residual radioactive contamination at Maralinga and Emu, 1985.** Lokan, K.H. (ed.). (Australian Radiation Lab., Melbourne). Apr 1985. 62p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86700483.

An account is provided of residual contamination at Maralinga and Emu, in South Australia, where the United Kingdom Atomic Weapons Research Establishment conducted nuclear weapons development trials between 1953 and 1963. Detailed information is presented about contamination levels at sites on the range where radioactive materials were dispersed. Some of these were associated with trials involving natural uranium or short-lived isotopes which are no longer present. There are four sites where plutonium-239 was dispersed in substantial quantities from minor trials and information is presented about its distribution. Much of this material has been diluted by mixing with local soil, but there is a significant quantity of material present in the form of contaminated fragments, particularly at Taranaki. A considerable quantity of uranium-235 is also present at Taranaki. An assessment is made of the radiological significance of the dispersed plutonium and it is concluded that the material represents a potential long term hazard while it remains in its present form. Residual radioactivity associated with all but one of the seven major trial sites involving nuclear explosions continues to decay in a predictable way and will in the worst case, fall below levels considered safe for continuous occupancy within about fifty years. One site, Tadje, contains significant concentrations of plutonium over a small area and is considered to be an additional plutonium-contaminated locality. Measurements of beryllium concentrations in soil are presented.

11899 **(CFFTP-G—85035) Elemental tritium deposition and conversion in the terrestrial environment.** Dunstall, T.G.; Ogram, G.L.; Spencer, F.S. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Jan 1985. 132p. NTIS (US Sales Only), PC A07/MF A01. File Number DE86700484.

Studies were undertaken to determine the deposition and conversion of atmospheric elemental tritium in soils and vegetation. In the field tritium deposition velocities ranged between 0.007 and 0.07 cm s^{-1} during the summer and autumn and were less than 0.0005 cm s^{-1} during the winter. Deposition velocity was found to depend significantly on soil water content, total pore space and organic content in controlled laboratory experiments. In contrast to soils, exposure of vegetation to atmospheric elemental tritium resulted in negligible uptake and conversion in foliage. These studies are of significance to the assessment of behaviour and impact of elemental tritium releases.

11900 **(EGG—10282-1081) Aerial radiological survey of the Portsmouth Uranium Enrichment Plant and surrounding area, Portsmouth, Ohio. Date of survey: May 1984.** (EG and G, Inc., Las Vegas, NV (USA). Energy Measurements Group). Sep 1985. Contract AC08-83NV10282. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004890.

An aerial radiological survey was performed over the area surrounding the Portsmouth Uranium Enrichment Plant during the period May 1 to 14, 1984. The survey covered an 83-square-kilometer (32-square-mile) area centered on the Plant. The highest radiation exposure rates, up to a maximum of 1.3 milliroentgens per hour (mR/h), were inferred from the data measured directly over the Plant. This detected radiation was due to the presence of uranium, which was consistent with normal Plant operations. For the remainder of the survey area, the inferred radiation exposure rates varied from 7 to 14 microentgens per hour (μR/h), which was found to be due to the naturally occurring uranium, thorium, and radioactive potassium gamma emitters. The reported exposure rate values include an estimated cosmic ray contribution of 3.7 μR/h. Ground-based measurements, conducted during the time of the aerial survey, were compared to the aerial results. Pressurized ionization chamber readings and a group of soil samples were acquired at several locations within the survey area and along the banks of

the Scioto River upstream and downstream of the survey area. The exposure rate values obtained from these measurements were in agreement with the inferred aerial results. No evidence of any radioactive contamination, which might have occurred off-site as a result of Plant operations, was inferred from the aerial survey data. This was further supported by the results of the soil sample analysis and the comparison of the current survey data with that collected during a previous survey conducted in July 1976. 7 refs., 11 figs., 2 tabs.

11901 **(HW—32041) Ground disposal of radioactive wastes at the Hanford site.** Parker, H.M. (General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation). 4 Jun 1954. Contract AC06-76RL01830. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005007.

The present disposal of radioactive wastes at the Hanford Atomic Products Operation is based on data developed in this report. A description is provided of typical ground disposal facilities including cribs. Laboratory studies on the behavior of plutonium, ruthenium, cerium, cesium, strontium, yttrium and gross fission products in typical local soils are described. 6 refs., 1 fig., 1 tab. (DT)

11902 **(HW—48356) Investigation of the effect of waste disposal procedure modifications on disposal of D-2 waste to the ground.** Rhodes, D.W. (General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation). 7 Feb 1957. Contract AC06-76RL01830. 7p. NTIS, PC A02. File Number DE86005009.

The results of a soil column experiment, which was conducted in December 1955, with a sample containing a waste evaporator condensate (D-2) and cell drainage (D-1) waste from Redox plant, indicated that ^{90}Sr breakthrough to the groundwater table in the immediate vicinity of the 216-S-1 and 2 cribs was a distinct possibility. For this reason a laboratory investigation was made to determine the reasons for the inadequate adsorption by soil of ^{90}Sr from this waste. Following the investigation modifications in the waste disposal procedure were made to reroute the D-1 waste to the waste evaporator, to adjust the pH of the D-2 waste to approximately pH 8 before disposal, and to relocate the disposal unit (crib) which received the condensate waste. This report presents the results of a recent laboratory evaluation of the effectiveness of these modifications. 1 fig., 1 tab.

11903 **(SKB-SP-TR—85-03) Final report of the migration in a single fracture - experimental results and evaluation.** Abelin, H.; Neretnieks, I.; Tunbrant, S.; Moreno, L. (Swedish Nuclear Fuel and Waste Management Co., Stockholm). May 1985. 162p. NTIS (US Sales Only), PC A08/MF A01. File Number DE86700485.

This report concerns a study which was conducted for the Stripa Project. The conclusions and view points presented in the report are those of the author and do not necessarily coincide with those of the client. A list of other reports published in this series is attached at the end of this report. Information on previous reports is available through SKB.

11904 **Comparison of predictions from internationally recognized assessment models for the transfer of selected radionuclides through terrestrial food chains.** Hoffman, F.O.; Bergstroem, U.; Gyllander, C.; Wilkens, A.B. (Oak Ridge National Lab., TN). *Nuclear Safety;* **25**: No. 4, 533-546(Jul-Aug 1984).

Six internationally recognized terrestrial food-chain models developed in Sweden, the United States, the United Kingdom, the Federal Republic of Germany, and the International Atomic Energy Agency are compared. This comparison includes the data bases and predictions for the transfer of Co-60, Sr-90, I-131, and Cs-137 into milk, and leafy and nonleafy vegetables from a hypothetical 30-yr continuous rate of atmospheric deposition onto agricultural systems. Model predictions are compared against United Nations summaries of empirical relationships between atmospheric deposition and concentrations in food of Sr-90 and Cs-137. The results of statistical analyses of the effect of parameter uncertainties on model predictions are also included for Sr-90, Cs-137, and I-131. Discrepancies among model predictions vary between factors of 6 and 30. These results reflect differences in model assumptions rather than uncertainties in model parameters.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 11042, 11043, 11921

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 10950, 10951, 10952, 10953

11905 **(DOE/ER/60351—1) Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, 1 Dec 1984-30 November 1985.** Blanton, J.O. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 17 Dec 1985. Contract FG09-85ER60351. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004964.

Simulations of wind generated flow over undulating topography representing the actual topography found off the coast of Georgia were run. Sharp impulses of northward wind stress which cause instabilities in the frontal zone (caused by interaction of the wind generated current with the undulating topography) can transport low salinity water initially within the frontal zone farther offshore and beyond the frontal zone. The presence or absence of a frontal zone depends upon a local (bottom-depth dependent) balance between buoyance inputs from solar radiation and freshwater (formation processes) and the power exerted by tidal currents at the bottom and wind stress at the surface (dissipation processes). We have completed some numerical simulations off the Georgia continental shelf which take into account gains and losses of buoyancy as well as wind-generated currents. The practical interpretation of results to date suggest that sothward wind stress induce convective instabilities near the leading edge of the front and the front reforms closer to shore. The water volume in which inputs from shore is diluted is reduced under these circumstances.

11906 **(DOE/ER/60354—T1) Biological processes in the water column of the South Atlantic Bight: zooplankton responses. Progress report, June 1985-June 1986.** Paffenhoefer, G.A. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 20 Dec 1985. Contract FG09-85ER60354. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004675.

The effects of wind forcing on water displacement from the near- to the offshore environment of the southeastern continental shelf are discussed. This report presents information on zooplankton abundance and distribution in relation to hydrographic variables. 7 figs. (ACR)

11907 **(DOE/EV/00890—9) Trace element geochemistry of the South Atlantic Bight. Progress report.** Windom, H.L. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). Dec 1985. Contract AS09-76EV00890. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004921.

This report summarizes work accomplished since 1 December 1984. Studies of nearshore sediment geochemistry have involved the collection of over 100 box cores within the coastal boundary zone. All of the cores have been x-radiographed and "peeled" to determine stratigraphy, and trace element analyses completed. During the past year we participated in SPREX (Spring Removal Experiment) and collected over 100 suspended sediment samples along transects perpendicular to shore in a region where coastal waters are hypothesized to be more efficiently transported across the shelf during the spring. 5 refs.

11908 **(DOE/EV/01340—14) Statistical look at air-sea interaction in the North Pacific.** Reiter, E.R.; Macdonald, B.C. (Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science). Oct 1984. Contract AC02-76EV01340. 51p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004995.

Environmental Research Paper No. 39.

This report examines the nature of sea surface temperature (SST) and atmospheric geopotential height patterns in the central North Pacific Ocean. Empirical orthogonal functions (EOFs) are developed for 5-day mean patterns of SST, 500 mb heights, 850 mb heights and 850/500 mb thicknesses from nearly 14 years of data. The effect of the mean annual cycle in these data is also examined. EOFs are developed for both individual data sets and for combinations of SST data with the atmospheric data. By comparing the time series for principal components of each data set, we identify patterns in SST and atmospheric data which may be indicative of air/sea interaction. Most of the deduced relationships, from lag correlation studies, indicate that the atmosphere "forces" the ocean. However, during fall and winter, some SST patterns appeared to preclude atmospheric anomalies. Apparent air/sea interactions with interseasonal persistence were demonstrated. Regions of the oceanic fronts appeared to be sensitive to SST anomaly formation under the effect of certain atmospheric flow patterns. 31 refs., 43 figs., 4 tabs.

11909 **(PB—85-236750/XAB) Upper bay network: a study of the plankton resources of the upper Chesapeake Bay. Volume 1, text. Volume 2, Appendices a-o. Final report 1982-1983.** Janicki, A.; Jacobs, F.; Burton, W.; Cummins, R. (Martin Marietta Environmental Systems, Columbia, MD (USA)). Feb 1985. 288p. NTIS, PC A13/MF A01.

Future needs for electrical generation in the State of Maryland will likely require the siting of a power plant in the upper Chesapeake Bay. Two sites have been considered as candidates: Perryman, located on the Bush River, and Bainbridge, located near the mouth of the Susquehanna River. Because the aquatic environments in the vicinity of these potential plants may be affected by the operation, it is essential to determine which aquatic habitats will be at risk and the relative value of the habitats with respect to important aquatic resources. Larval fish were collected in the various habitats during the summer of 1982 and the spring and summer of 1983. Two habitat characteristics - salinity and presence of SAV - were important determinants of the abundance and distribution of larval fishes, as well as those of the macro- and meso-plankton.

11910 **(TR-EL—82-4) Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico). Grass shrimp.** Anderson, G. (University of Southern Mississippi, Hattiesburg (USA). Dept. of Biological Sciences). Mar 1985. 26p. NTIS, PC A03/MF A01. File Number TI86900191.

This species profile summarizes much of the literature published about the biology of grass shrimp, Palaemonetes spp. Five species (P. pugio, P. vulgaris, P. intermedius, P. paludosus, and P. kadiakensis) are common in coastal waters of the northern Gulf of Mexico, although the last two are primarily freshwater forms. The brackish-water species are among the most abundant shallow-water benthic decopods in estuaries and play important roles as food for fishes and as transporters of nutrients among various trophic levels. They spawn from spring to autumn and the growth of planktonic larvae is normally competed in 7 to 12 molts. Postlarvae of 7 to 10 mm are 1.5 to 2 months old. The life span of grass shrimp is 6 to 13 months (maximum size rarely exceeds 50 mm). Palaemonetes spp. are eurythermal, euryhaline, and are relatively tolerant to hypoxia and variety of pollutants. Grass shrimp feed on detritus, epiphytes, and meiofauna. They tend to concentrate near underwater structures and plants, especially in dense stands of underwater macrophytes.

11911 **(TR-EL—82-4/82-11.40) Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic). Mummichog and striped killifish.** Abraham, B.J. (Hampton Univ., VA (USA). Dept. of Biological Sciences). Jun 1985. 30p. NTIS, PC A03/MF A01. File Number TI86900199.

Mummichogs and striped killifish are not commercial or sport fish; however, their distribution and abundance make them important in nearshore and estuarine food webs. These are two of the three most common killifishes on the Mid-Atlantic coast; summer density of mummichogs in estuaries may be as high as six per square meter. Most members of both species attain sexual maturity and spawn during their second year. Mummichogs have a semilunar spawning periodicity during the spawning season; eggs incubate in air and are not submerged until the next spring tide after they are laid. Young mummichogs remain on the marsh for 6 to 8 weeks, then begin to move off with the tides, with the adults. Mummichogs and striped killifish are euryphagous predators. Both species are tolerant of temperature and salinity fluctuations. Mummichogs are rarely taken in full seawater; striped killifish rarely, if ever, enter freshwater. Between these extremes, the habitats of the two species overlap.

11912 **Predicting the effect of macro-benthos on the sediment/water flux of metals and phosphorus.** Starkel, W.M. (Connecticut Univ., Storrs). *Canadian Journal of Fisheries and Aquatic Science;* 42: No. 1, 95-100(Jan 1985). Contract AC09-76SR00819.

Exchange between sediments and water is an important aspect of the movement of materials and energy in lakes. The effect of macrobenthos on exchange processes was studied in a small, softwater lake. The profundal macrobenthos is composed mainly of Chaoborus larvae at densities often exceeding 20,000/sq m. Chironomid larvae are much less abundant but account for 5% of the total mass of macroinvertebrates. The log-transformed flux rates of iron, manganese, and phosphorus were linearly related to the biomass of Chaoborus and chironomid larvae. Predicted flux rates of iron and phosphorus at average pelagic densities of animals were enhanced at least twofold over predicted fluxes for diffusion alone. Macroinvertebrates had no apparent effect on flux rates of dissolved oxygen, dissolved inorganic carbon, potassium, or sodium. Because both iron and phosphorus have concentration gradients across the sediment/water interface, a mixing effect, rather than excretion alone, is implicated for the effect of animals on phosphorus flux. 17 references, 3 figures, 2 tables.

11913 **Multidisciplinary oceanography program on the southeastern US continental shelf.** Blanton, J.O.; Yoder, J.A.; Atkinson, L.P.; Lee, T.N.; McClain, C.R.; Mensel, D.W.; Paffenhofer, G.A.; Pietrafesa, L.J.; Pomeroy, L.R.; Windom, H.L. (Skidaway Institute of Oceanography, Savannah, GA). *EOS, Transactions, American Geophysical Union;* 1202-1203(4 Dec 1984). Contract AS09-80EV10331.

Since 1976, the US Department of Energy has sponsored a multidisciplinary research program to determine the physical processes which drive circulation and control the chemistry and biology of the continental shelf waters off the southeastern United States. This area extends from Cape Hatteras, North Carolina to Cape Canaveral, Florida (often called the South Atlantic Bight (SAB)). Knowledge gained about water circulation across the shelf and at the western edge of the Gulf Stream has been used by cooperating investigators and others to describe the circulation of shelf water, to determine where and how certain trace elements are transported and transformed, and to relate the circulation regime to biological production. The program is presented under three headings: circulation, trace element geochemistry, and food chain dynamics.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 10804, 10808, 10811, 10940, 10941, 10942, 10943, 10944, 10947, 10948, 10949, 10950, 11480, 11632, 11894, 11896, 11897, 11919, 12028, 12034

11914 **(AD-A—158096/8/XAB) Sorption and desorption of volatile chlorinated aliphatic compounds by soils and soil components. Doctoral theses.** La Poe, R.G. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). Jun 1985. 325p. (AFIT-CI—NR-85-99T). NTIS, PC A14/MF A01.

Many groundwater supplies in the industrialized nations of the world are contaminated with low concentrations of certain volatile, chlorinated, aliphatic compounds, such as trichloroethylene (C_2HCl_3), tetrachloroethylene (C_2Cl_4), carbon tetrachloride (CCl_4), and chloroform ($CHCl_3$). One aspect of this problem, about

which very little is known, is that of the (potential) sorption of these chemicals (in dilute aqueous systems) by the soils comprising the groundwater aquifers, and by soils and soil components in general. This research was performed to expand our very limited knowledge in this area, and utilized 14C-labeled sorbates in conjunction with liquid scintillation counting. This investigation has shown that the above compounds are negligibly adsorbed by the inorganic solids (clays and minerals) which would typically comprise subsurface soils, with some evidence suggesting that they are slightly negatively adsorbed by these solids. Sorption (and some desorption) isotherms were determined for each sorbate with each of the following sorbents: a mineral soil, a peat soil, a muck soil, activated carbon, graphite, humic acid, and lignin, The sorption equilibrium distribution coefficients (K subscript d) in the linear, low-concentration regions of these isotherms were determined for each sorbent-sorbate system.

11915 **(PB—85-236719/XAB) Analysis of extractable priority pollutants in water by gas chromatography/mass spectroscopy.** Shackelford, W.M.; McGuire, J.M. (Environmental Protection Agency, Athens, GA (USA). Environmental Research Lab.). Jul 1985. 20p. (EPA/600—D-85/149). NTIS, PC A02/MF A01.

Following the June 1976 Consent Decree (NRDC et al. vs. EPA), there has been a continuously increasing demand for the analysis of water samples for the 129 priority pollutants. The protocol originally designed for the analysis of the priority pollutants that are extractable into dichloromethane has been refined to take advantage both of increased experience by analytical chemists and improvements in laboratory instrumentation and automation. Quality control procedures have been set forth that are designed to insure top quality laboratory performance and establish confidence in the reliability of results over a wide range of sample matrices. This paper follows the development of present methodology for the analysis of extractable priority pollutants in water.

11916 **(PB—85-237428/XAB) Toxic effects on individuals, populations, and aquatic ecosystems and indicators of exposure to chemicals.** Duke, T.W.; Mount, D.I. (Environmental Protection Agency, Gulf Breeze, FL (USA). Environmental Research Lab.). Jul 1985. 25p. NTIS, PC A02/MF A01.

The paper presents two research approaches that address problems encountered in evaluating the effects of complex mixtures of chemicals on aquatic systems. The concept of ambient toxicity testing is applied to the impact of effluents in freshwater receiving waters (the concept also applies to saltwater systems), where measurement of toxicity is made without attempting to identify the toxics. Another approach develops structural and functional indices that can be used to evaluate impact of chemicals on communities maintained under controlled conditions in the laboratory. One approach is concerned with chemicals already in the environment; the other, with developing ecosystem level indices used to evaluate chemicals before they reach the environment. Also, applicability of laboratory-derived data to field situations is discussed.

11917 **Heavy metals and other trace elements.** Leland, H.V.; Copenhaver, E.D.; Corrill, L.S. (Univ. of Illinois, Urbana-Champaign). *Journal - Water Pollution Control Federation;* **46**: No. 6, 1452-1476(Jun 1974).

A literature review is presented on the cycling of trace elements through the environment. Topics of interest include: trace element sources; trace elements and human health; trace elements in natural waters; trace elements in sediments; and accumulation and toxicity of trace elements. 257 references.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11037, 11057, 11058, 11060, 11062, 11063, 11064, 11067, 11068, 11559, 11883, 11884, 11885, 11902, 11923, 11923

11918 **(AD—420340/2/XAB) Radiological water decontamination study.** Lindsten, D.C. (Army Engineer Research and Development Labs., Fort Belvoir, VA (USA)). 29 Apr 1963. 69p. NTIS, PC A04/MF A01.

This study showed that (1) The solubility of radioactive debris increased with a decrease in pH and an increase in temperature, but the change was not significant in the pH and temperature variations for normal drinking water supplies. (2) The solubility of radioactive debris was not markedly affected by contact time. (3) The solubility of radioactive debris was significant enough to require water demineralization to produce drinking water within the acceptable one year and one month drinking water tolerance levels. (4) Radioactive debris from surface detonations can be colloidal and remain in suspension in water for extended periods of time and be readily transported to downstream water sources; and (5) Emergency type water purification methods such as filtration through clay and paper, batch coagulation, filtration through a cellulose filter disc, and molded filter candles effectively reduced radioactive contaminants to short range (less than 30 days) drinking water tolerance levels. (Author)

11919 **(PB—85-237154/XAB) Coupled lakes model for estimating the long-term response of the Great Lakes to time-dependent loadings of particle-associated contaminants. Technical Memo.** Robbins, J.A. (National Oceanic and Atmospheric Administration, Ann Arbor, MI (USA). Great Lakes Environmental Research Lab.). Apr 1985. 49p. (NOAA-TM-ERL-GLERL—57). NTIS, PC A03/MF A01.

The Coupled Lakes Model is a mathematical formalism and associated computer program for estimating the response of each of the Great Lakes to time-dependent loadings of tracers and contaminants. The model characterizes inputs arising from atmospheric delivery directly to the lakes and indirectly as losses from the drainage basins. The model treats the lakes as though instantaneously mixed and assumes equilibrium partitioning of constituents between water and suspended solids. Included in the formalism are the effects of particle settling, resuspension, mixed layer integration, radioactive decay and other first-order biogeochemical losses. Cs-137, and Pu-239/240, in combination with measured concentrations in water and in resuspended materials, provide an excellent preliminary calibration of the model.

11920 **(PB—85-237162/XAB) Great Lakes regional fallout source functions. Technical memo.** Robbins, J.A. (National Oceanic and Atmospheric Administration, Ann Arbor, MI (USA). Great Lakes Environmental Research Lab.). Feb 1985. 29p. (NOAA-TM-ERL-GLERL—56). NTIS, PC A03/MF A01.

Atmospheric concentrations and rates of deposition of long-lived fallout radionuclides Sr^{90}, Cs^{137}, and Pu^{239} and Pu^{240} were measured extensively and routinely over the past 30 years at numerous sites in the Great Lakes Region. The data set provides the most accurate and complete record of any contaminant entering the lakes and, when combined with carefully measured lake responses, adds greatly to understanding of how the system recovers. In the report all known regional fallout data through the 1980's are combined to give the most accurate estimate of the rates of deposition of the three nuclides over the drainage basin and open lake. A previously validated model (PWW), used to relate atmospheric deposition rates, is used to infer lake and basin deposition based on mean regional atmospheric concentrations and mean precipitation extrapolated from a network of more than 2,000 precipitation sampling sites. Results are given in terms of monthly deposition rates for each lake and its drainage basin for the three nuclides.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 11922

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 11042, 11043

11921 **(SRO—819-16) Ecological research at the Savannah River Ecology Laboratory. Annual report for the period ending July 31, 1985.** Strojan, C.L.; Novak, S.S.; Wolf, R.B. (eds.). (Savannah River Ecology Lab., Aiken, SC (USA)). Sep 1985. Contract AC09-76SR00819. 160p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86005256.

This report summarizes ecological research conducted at the Savannah River Ecology Laboratory (SREL) during the annual period ending July 31, 1985. The primary goal is to develop an understanding of the impact of various energy technologies and management practices on the ecosystems of the southeastern United States. SREL research is conducted by interdisciplinary research teams organized under three major divisions: (1) Biogeochemical Ecology, (2) Wetlands Ecology, and (3) Stress and Wildlife Ecology. Separate abstracts have been prepared for each division. (ACR)

5206 Regulations

11922 **(DP—1708) Compliance of the Savannah River Plant P-Reactor cooling system with environmental regulations. Demonstrations in accordance with Sections 316(a) and (b) of the Federal Water Pollution Control Act of 1972.** Wilde, E.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Dec 1985. Contract AC09-76SR00001. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86005343.

This document presents demonstrations under Sections 316(a) and (b) of the Federal Water Pollution Control Act of 1972 for the P-Reactor cooling system at the Savannah River Plant (SRP). The demonstrations were mandated when the National Pollution Discharge Elimination System (NPDES) permit for the SRP was renewed and the compliance point for meeting South Carolina Class B water quality criteria in the P-Reactor cooling system was moved from below Par Pond to the reactor cooling water outfall, No. P-109. Extensive operating, environmental, and biological data, covering most of the current P-Reactor cooling system history from 1958 to the present are discussed. No significant adverse effects were attributed to the thermal effluent discharged to Par Pond or the pumping of cooling water from Par Pond to P Reactor. It was conluded that Par Pond, the principal reservoir in the cooling system for P Reactor, contains balanced indigenous biological communities that meet all criteria commonly used in defining such communities. Par Pond compares favorably with all types of reservoirs in South Carolina and with cooling lakes and reservoirs throughout the southeast in terms of balanced communities of phytoplankton, macrophytes, zooplankton, macroinvertebrates, fish, and other vertebrate wildlife. The report provides the basis for negotiations between the South Carolina Department of Health and Environmental Control (SCDHEC) and the Department of Energy - Savannah River (DOE-SR) to identify a mixing zone which would relocate the present compliance point for Class B water quality criteria for the P-Reactor cooling system.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 11072, 11389, 12139

5302 Assessment Of Energy Technologies

11923 **(WTSD-TME—3151) Radiological consequences of brine release by human intrusion into WIPP.** Woolfolk, S. (Westinghouse Electric Corp., Carlsbad, NM (USA)). 1 Jul 1982. Contract AC04-78AL05346. 157p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86004344.

As a result of new scientific information, two limiting credible scenarios are evaluated for inclusion with the final environmental impact statement. All data used were chosen to produce a realistically conservative result, but actual consequences would probably be several orders of magnitude lower than these reported results. (PSB)

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 10938, 10964

55 BIOMEDICAL SCIENCES, BASIC STUDIES

11924 **(INDC(NDS)—165/GR) Planning for the REAL-84 project on adjustment procedures. Report of an IAEA consultants' meeting held in Hamburg, Federal Republic of Germany, 26 September 1984.** Piksaikin, V.; Zijp, W.L. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jul 1985. 7p. (CONF-8409309—). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701201.

From IAEA consultants meeting on the REAL-84 exercise; Hamburg, F.R. Germany (26 Sep 1984).

The report presents the data requirements and the recommendations for REAL-84 project in order to improve the assessment of accuracies in radiation damage predictions.

11925 **(ITEF—20(1984)) Bank of data on nuclear inclusive cross-sections at high-energies of projectiles.** Bayukov, Yu.D.; Volodina, T.N.; Efremenko, V.I.; Klumov, I.A.; Kolkunova, L.G.; Shatrovskaya, N.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701202.

The data bank containing experimental values of inclusive cross sections of high energy particles interactions ($T > 0.5$ GeV) with nuclei is described. The description of access facilities is given. 5 references.

5501 Behavioral Biology

REFER ALSO TO CITATION(S) 12016

5502 Biochemistry

REFER ALSO TO CITATION(S) 11129, 11565, 11952, 11953, 11954, 11955, 11956, 11958, 11962, 11971, 12007, 12088

11926 (CONF-840192—, pp 120-132) **Regulation of glycoprotein synthesis in yeast by mating pheromones.** Tanner, W. (Universitaet, Regensburg, West Germany). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

In Saccharomyces cerevisiae, glycosylated proteins amount to less than 2% of the cell protein. Two intensively studied examples of yeast glycoproteins are the external cell wall - associated invertase and the vacuolar carboxypeptidase Y. Recently, it was shown that the mating pheromone, alpha factor, specifically and strongly inhibits the synthesis of N-glycosylated proteins in haploid a cells, whereas O-glycosylated proteins are not affected. In this paper, the pathways of glycoprotein biosynthesis are summarized briefly, and evidence is presented that mating pheomones have a regulatory function in glycoprotein synthesis.

11927 (CONF-840192—, pp 133-149) **Regulatory mechanisms for the synthesis of β-glucans in plants.** Delmer, D.P.; Thelen, M.; Marsden, P.F. (ARCO Plant Cell Research Institute, Dublin, CA). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The mechanism for synthesis of a polymer is integrated so closely with the regulation of its synthesis that studies of synthesis and regulation often occur in parallel. One case in point concerns the recent success reported for obtaining high rates of in vitro synthesis of beta-1,4-glucan using cell-free preparation derived from the bacterium, Acetobacter xylinum. In this paper, the authors present a tentative working model for a system of opposing modes of regulation for the synthesis of cellulose (beta-1,4-glucan) and callose (beta-1,3-glucan) in a higher plant, the developing cotton fiber.

11928 (CONF-840192—, pp 150-166) **Xylanase action on alfalfa cell walls.** Greve, L.C.; Labavitch, J.M.; Hungate, R. (Univ. of California, Davis). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The authors' interest in understanding cell wall structure is based on a desire to understand cell wall metabolism which accompanies much of plant development, combined with the interests of rumen microbiologists who wish to understand the biochemistry of plant fiber digestion. The approach used here has been to follow the utilization of wall components by the rumen bacterium Ruminococcus albus strain 8 (Ra 8) when it is cultured on alfalfa cell walls (ACW). This paper describes preliminary studies of the action of purified Ra8 beta-1,4-xylanases on model substrates, on hemicelluloses extracted from ACW, and on unmodified ACW preparations. The analysis of digestion products suggests a significant heterogeneity of structure in these walls. Factors which may influence this perception of heterogeneity are discussed.

11929 (CONF-840192—, pp 167-184) **Depolymerization of matrix polysaccharides by endogenous wall enzymes.** Nevins, D.J.; Hatfield, R.; Kato, Y. (Iowa State Univ., Ames). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

β-D-Glucans with regular intramolecular sequences of (1 → 3) and (1 → 4) linkages are recognized as major components of cereal endosperm cell walls and have recently been studied as important constituents of primary walls. While no specific role for these β-D-glucans in wall development has been established, their unique physical properties and certain aspects of its metabolism are consistent with their potential for modification of wall properties. Since elongation, governed by wall expansion, is thought to be an integrated process of wall lysis and synthesis coordinated with tugor-induced displacement, a role for these β-D-glucans in this event is considered a likely possibility. In this paper, the beta-D-glucan as a primary well component, and endogenous enzymes involved in glucan hydrolysis are discussed.

11930 (CONF-840192—, pp 254-267) **Intracellular localization of hydroxyproline-rich glycoprotein biosynthesis.** Robinson, D.G.; Andreae, M.; Glas, A.R.; Sauer, A. 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The structural proteins of plant cell walls are glycoproteins characterized by O-glucosidic linkages to hydroxyproline or serine. Proline, not hydroxyproline, is the translatable amino acid in hydroxyproline-rich glycoproteins (HRGP). Hydroxylation and arabinosylation of proline are sequential, post-translational events. Because of this, there is no a priori reason for expecting HRGP synthesis to follow the well-established route for secretory and plasma membrane (PM) glycoproteins, i.e., from endoplasmic reticulum (ER) via the Golgi apparatus (GA) to the PM. In this paper, two plausible alternatives for HRGO secretion are examined. Because a feature of the majority of dicotyledons is overlapping GA and PM regions in sucrose density gradients, the authors have used two monocotyledonous systems to determine the distribution of HRGP and enzyme activity.

11931 (CONF-840192—, pp 268-283) **Cell wall proteins extracted from suspension-cultured cells.** Scott, T.K.; O'Neill, R.A. (Univ. of North Carolina, Chapel Hill). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

This paper is one of a series of three which describe work on cell wall proteins of suspension culture carrot cells. These papers detail methodology and results of work designed to allow the selective examination of proteins from a compartment of the cell whose complexity is only beginning to be appreciated. This paper emphasizes the development and nature of the experimental system. In particular, different methods of protein extraction are examined and compared. In addition, further data on enzyme activities found in wall protein extracts are presented.

11932 (CONF-840192—, pp 284-301) **Auxin-induced modifications of cell wall polysaccharides in cat coleoptile segments. Effect of galactose.** Yamamoto, R.; Masuda, Y. (Tezukayama Junior College, Nara, Japan). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Galactose inhibits auxin-induced cell elongation in oat coleoptile segments. Cell elongation induced by exogenously applied auxin is controlled by factors such as auxin uptake, cell wall loosening, osmotic concentration of sap and hydraulic conductivity. However, galactose does not have any effect on these factors. The results discussed in this paper led to the conclusion that galactose does not affect cell wall loosening which controls rapid growth, but inhibits cell wall synthesis which is required to maintain long-term growth.

11933 (CONF-840192—, pp 302-343) **Fungal penetration of defensive barriers of plants.** Kolattukudy, P.E. (Washington State Univ., Pullman). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Plants, like all other living organisms, are packaged in an outer envelope which acts as the barrier between the plant and its environment. The outer envelop of the aerial parts of plants (the cuticle) consists of a polyester, called cutin, which is embedded in a soluble mixture of relatively nonpolar lipids, collectively called waxes. The insoluble structural polymer, cutin, constitutes the major barrier to invasion by pathogenic microbes. The underground parts and aerially formed periderms and barks are protected

by a different type of insoluble polymeric material called suberin. This polymer is also associated with waxes which make this layer resistant to diffusion. It has been known for a long period of time that these protective barriers are breached by pathogenic fungi. In this chapter, the nature of these barriers and how pathogenic fungi penetrate such barriers during infection are discussed. Topics include the composition, location and ultrastructure of cutin and suberin; and the isolation and properties of cutinase.

11934 (CONF-840192—, pp 359-379) **Pectic fragments of plant cell walls as mediators of stress responses.** West, C.A.; Bruce, R.J.; Jin, D.F. (Univ. of California, Los Angeles). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The plant cell wall has long been recognized as an important factor in the resistance of the plant to invasions by potentially pathogenic fungi and bacteria. A variety of roles have been proposed for the plant cell wall, ranging from a more passive mechanical barrier to an active capacity for interaction with the invading organism. The concept that oligosaccharides derived from the plant cell wall may serve a variety of regulatory functions in plant development, including those involved in disease resistance, has been introduced. This paper deals with one aspect of this more general concept - the role of pectic fragments of the plant cell wall as mediators of stress responses.

11935 (CONF-840192—, pp 397-399) **Hydroxyproline synthesis is required for cell wall regeneration.** Cooper, J.B. (Washington Univ., St. Louis, MO). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The role of hydroxyproline-rich glycoproteins in cell wall structure is speculative and, thus, remains controversial. Hydroxyproline-rich polymers are synthesized and secreted during wall regeneration. The author has utilized a specific inhibitor of prolyl hydroxylase, 3,4-dehydro-L-proline, to probe the function of hydroxyproline-containing macromolecules in the cell wall formed during wall regeneration by tobacco cell protoplasts.

11936 (CONF-840192—, pp 400-408) **Model for the mechanism and regulation of chitosan synthesis in Mucor rouxii.** Davis, L.L.; Bartnicki-Garcia, S. (Univ. of California, Riverside). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The cell walls of mucoraceous fungi are characterized by the joint occurrence of chitosan and chitin, the β-1,4-linked polysaccharides of GlcN and GlcNAc, respectively. It has been proposed that chitosan is made from chitin by enzymatic deacetylation, but the evidence is inconclusive since the deacetylase isolated from Mucor rouxii is effective against glycol chitin, but not against genuine chitin; consequently, chitosan synthesis in vitro was not achieved. The authors discovered that the same deacetylase can deacetylate chitin efficiently if it is allowed to act on chitin chains as they are being formed; i.e. the simultaneous presence and operation of chitin synthetase and chitin deacetylase is required for chitosan synthesis. Subsequent studies on the effect of digitonin on chitosan synthesis were the basis for a model the authors have developed for the regulation of chitosan and chitin syntheses in vivo.

11937 (CONF-840192—, pp 409-412) **Identification of oligogalacturonide-elicitors of phytoalexin accumulation released from sodium polypectate by an endopolygalacturonic acid lyase.** Davis, K.R.; Darvill, A.G.; Albersheim, P. (Univ. of Colorado, Boulder). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403. Contract AC02-76ER01426.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Plants often respond to microbial infection by producing low-mol wt, antimicrobial compounds called phytoalexins. Phytoalexin accumulation can be induced by molecules called elicitors. Recent work in this laboratory has demonstrated that a bacterial pectin-degrading enzyme, α-1,4-endopolygalacturonic acid lyase, is an elicitor of phytoalexin accumulation in soybean cotyledons. It was also shown that this enzyme released heat-stable, galactosylruronic acid-rich elicitors from soybean cell walls, citrus pectin, and sodium polypectate. As a first step in identifying the elicitor-active molecules that the lyase releases from these various substrates, the authors have purified the most active components from a crude elicitor preparation derived from sodium polypectate.

11938 (CONF-840192—, pp 413-414) **Ultrastructure and biochemistry of endosperm breakdown in date palm (Phoenix dactylifera L.) seeds.** DeMason, D.A.; Sexton, R.; Reid, J.S.G. (Univ. of California, Riverside). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

During germination of the date seed, the cotyledon's distal portion forms an enlarged haustorium which replaces the endosperm. The zone of endosperm breakdown is a lightly staining, narrow area immediately adjacent to the surface of the haustorium. An assayable amount of enzyme activity was found for two cell wall hydrolases, endo-β-mannanase, β-mannosidase, and a proteinase. The pH optima for these enzymes ranges between 4 and 5. The proteinase has a requirement for a reducing agent. Date seeds at various stages of germination were dissected and various tissues assayed for these enzymes.

11939 (CONF-840192—, pp 415-418) **Influence of α sex factor on the biosynthesis of the cell wall from Saccharomyces cerevisiae.** Diaz, S.; Zinker, S.; Ruiz-Herrera, J. (Universidad de Guanajuato, Mexico). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Cells of Saccharomyces cerevisiae produce peptide hormones (a and α) which dramatically affect the physiology, structure, and behavior of cells from the opposite mating type, presumably in preparation for conjugation. Some cell division cycle mutants mimick several of the changes induced by α factor. Accordingly, conditional mutants cdc 28, cdc 36, cdc 37, and cdc 39 undergo arrest in G1, exhibit shmoo morphology and are able to mate when they are transferred to the restrictive temperature. Formation of shmoo cells would require increased synthesis of glycosyl transferases involved in the biosynthesis of cell wall polysaccharides. Accordingly, the authors investigated the effect of G1 arrest on the chemical composition of the cell wall and on the levels of glycosyl transferases. Arrest in G1 was obtained by two methods: addition of α factor, and transfer of a cdc 28 mutant to the restrictive temperature.

11940 (CONF-840192—, pp 423-432) **Utilization of glucose and UDPG by supprotoplasts of cotton fiber cells.** Gould, J.H.; Dugger, W.M. (Univ. of California, Riverside). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The authors have developed a subprotoplast system for cotton fiber cells isolated after initiation of secondary wall and cellulose synthesis. In the absence of a cell-free system for cellulose synthesis, protoplasts and subprotoplasts offer an opportunity to study cellulose synthesis as well as precursor utilization. In these systems, however, the incorporation of precursor is confused by an unknown mode of uptake from the culture medium. These studies

were undertaken to clarify the uptake question. Results could corroborate a model of UDP-glucose utilization at the plasma membrane surface or uptake of an intact molecule. The cotton fiber subprotoplast system appears to synthesize a product characteristic of cellulose in enough quantity for further characterization, and may prove to be useful in studying some aspects of cellulose synthesis.

11941 (CONF-840192—, pp 449-456) **Possible role for hemicelluloses in fruit softening.** Huber, D.J. (Univ. of Florida, Gainesville). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

In this study, gel-exclusion chromatography was employed to assess possible changes in the hemicellulosic polysaccharides during the softening of ripening strawberry and tomato fruit. In order to determine the relationship, if any, between changes affecting neutral polymers and enzymatic pectin hydrolysis, the soluble pectic substances were also examined.

11942 (CONF-840192—, pp 464-467) **Sterol composition of chitosomes from Mucor rouxii, comparison with whole cells.** Lopez-Romero, E.; Gonzalez, E.M. (Universidad de Guanajuato, Mexico). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Chitosomes are spheroid structures 40 to 70 nm in diameter which play a direct role in the cellular mechanism of fungal cell wall synthesis. The relative abundance of sterols in chitosomes, as well as the findings in this paper, indicate that these lipids might play an important role in the mechanism of chitin biosynthesis. The authors investigated the sterol composition of chitosomes and, for comparison, that of whole yeast and mycelial cells.

11943 (CONF-840192—, pp 468-474) **Membrane-bound β-lectins: agglutination of protoplasts by multivalent phenyl-β-glucosides.** Nothnagel, E.A.; Lyon, J.L. (Univ. of California, Riverside). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Many plants contain buffer-soluble arabinogalactan-proteins that bind to certain phenyl-β-glycosides. Protoplast plasma membranes also contain components that bind to phenyl-β-glycosides. These membrane components are called β-lectins. The presence of β-lectins on the plasma membrane was inferred from the observation that plant protoplasts could be agglutinated by synthetic, multivalent ligands called Yariv antigens. Plant protoplasts could be agglutinated by Yariv antigens containing residues in β-anomeric linkage, but not by Yariv antigens containing any of these sugars in α-anomeric linkage. Other characteristics of β-lectin binding are still poorly understood. The goal is the further characterization of membrane-bound β-lectins. This preliminary communication reports the initial investigation of new probes for possible use in quantitative measurements of ligand binding by membrane-bound β-lectins.

11944 (CONF-840192—, pp 477-482) **Could phytoalexin elicitors operate by a crosslinking mechanism?.** Saxton, M.J.; Breidenbach, R.W. (Univ. of California, Davis). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403. Contract AT03-80ER10700.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

While considerable progress has been made toward the characterization of carbohydrate elicitors of phytoalexins and membrane receptors for the elicitors, little is known of the mechanisms by which the signal that initiates phytoalexin production is transmitted across the plasma membrane. The authors hypothesize that carbohydrate elicitors act by cross-linking membrane receptors. Such a mechanism is well known in animal cells. First, the authors discuss the precedents from animal systems, and then the predictions of their hypothesis for elicitor action.

11945 (CONF-840192—, pp 498-500) **KDO (3-deoxy-manno-octulosonic acid), a glycosyl residue thought to occur only in enterobacterial polysaccharides, is also a component of the cell wall of higher plants.** York, W.S.; McNeil, M.; Darvill, A.G.; Albersheim, P. (Univ. of Colorado, Boulder). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403. Contract AC02-76ER01426.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

KDO (3-deoxy-manno-octulosonic acid) has been found previously only in the lipopolysaccharides and capsular polysaccharides produced by enterobacteria. Recently, the authors found that this unusual eight-carbon acid sugar is also a component of the cell walls of suspension-cultured sycamore cells. The unique properties of this sugar made it difficult to detect by the usual methods employed to determine the composition of plant cell walls. However, its extreme susceptibility to acid hydrolysis when glycosidically linked to another sugar, facilitated the release of a disaccharide, with KDO at the reducing terminus, from the purified cell wall polysaccharide rhamnogalacturonon II (RG-II). These studies indicate that the structure of RG-II includes a disaccharide composed of a rhamnopyranosyl residue glycosidically linked to a KDO residue, probably through 0-5 of the KDO residue.

11946 (CONF-841293—1) **Hydrogen bonding patterns and dynamics in biological macromolecules.** Saenger, W.; Betzel, C.; Zabel, V.; Brown, G.M.; Hingerty, B.E.; Lesyng, B.; Mason, S. (Oak Ridge National Lab., TN (USA); Freie Univ. Berlin (Germany, F.R.). Inst. fuer Kristallographie; Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej; Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). 1984. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004807.

From International symposium on biomolecular structure and interactions; Bangalore, India (17 Dec 1984).

Hydrogen bonds always involve hydrogen atoms which cannot be located by x-ray diffraction methods in macromolecular structures above 2000 daltons. Application of neutron diffraction could resolve this problem if technical problems like low flux and limited size of crystals were solved. Small biological molecules can serve as a first step in these investigations in order to derive basic principles. Suitable model systems for such studies are cyclodextrins which contain a large number of OH groups. They co-crystallize with water and provide new insight in the formation and dynamics of hydrogen bonding patterns. 18 refs., 10 figs., 2 tabs.

11947 (DOE/ER/60068—2) **[Templates, site specifically modified with carcinogens]. Final report.** (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1985. Contract AC02-82ER60068. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004296.

Progress is reported on the fidelity of DNA polymerases replicating oligonucleotides containing a bulky adduct. Studies are also presented on the structure of and DNA-cloning of the lac operator of Escherichia coli. 25 refs., 4 figs. (DT)

11948 **Circular intensity differential scattering of light by hierarchical molecular structures.** Patterson, C.W.; Singham, S.B.; Salzman, G.C.; Bustamante, C. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **84**: No. 3, 1916-1921(1 Feb 1986).

We show that circular intensity differential scattering (CIDS) of light by macromolecules with different levels of chiral structure is the superposition of the CIDS from each individual level. As an example, we treat a model superhelix with anisotropic polarizability.

11949 **Correlation between bioassay and radioimmunoassay for erythropoietin in human serum and urine concentrates.** Cohen, R.A.; Clemons, G.; Ebbe, S. (Lawrence Berkeley Lab., CA). *Proceedings of the Society for Experimental Biology and Medicine;* 179: No. 3, 296-299(Jul 1985). Contract AC03-76SF00098.

Both immunoreactive erythropoietin (Ep) and biologically active Ep were measured in 23 samples of human serum and 21 concentrates of human urine. Immunoreactive Ep was measured by radioimmunoassay (RIA). Biological activity was determined in the plethoric mouse bioassay in which ^{59}Fe incorporation was converted to units of Ep from standard reference curves. Low values for Ep were determined from standard curves plotted as probits to improve sensitivity for levels of Ep as low as 30 mU/ml. Ep levels in 35 samples ranged between 30 and 1000 mU/ml by both assays; in 9 samples Ep was 15.2-37.5 mU/ml by RIA but was not detectable by bioassay. Analysis of the data for the 35 samples in which Ep could be measured by both assays showed a strong correlation between the values obtained by the two assays. These results indicate that the RIA used in these experiments detects biologically active Ep in human serum and urine when it is present in amounts only moderately higher than normal. The ultrafiltration method used for preparation of urine samples was effective in concentrating Ep in some urines, but the results were too erratic and nonquantitative to permit its use as a method for quantifying human urinary Ep excretion.

5503 Cytology

REFER ALSO TO CITATION(S) 11927, 11928, 11929, 11933, 11935, 11941, 11942, 11943, 11944, 11945, 11970, 11983

11950 (CONF-840192—, pp 1-18) **Kingdoms with walls.** Bartnicki-Garcia, S. (Univ. of California, Riverside). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

This chapter is devoted to an assessment of the role of the cell wall in evolution. The cell wall is best known for its rather passive function of providing a protective enclosure for the cell. But the importance of the wall extends far beyond protection: the cell wall permits many an organism to develop a particular lifestyle. The various stages in the evolution of cell walls are examined. The cell walls of eukaryotes which are microfibrillar in nature are discussed in some detail.

11951 (CONF-840192—, pp 19-51) **Why study the structures of biological molecules? The importance of studying the structures of complex carbohydrates.** Albersheim, P.; Darvill, A.G.; Davis, K.R.; Lau, J.M.; NcNeil, M.; Sharp, J.K.; York, W.S. (Univ. of Colorado, Boulder). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403. Contract AC02-76ER01426.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The primary cell walls of all higher plants appear to be formed from a set of polysaccharides and a single glycoprotein. The analogous polymers in the cell walls of different plants appear to have the same general structures, although the proportions of the different polymers are very different in distantly related plants. The authors suggest that the polysaccharides of the walls of different cells, organs and tissues of a single plant also differ in structure from one another. These structural differences may encode different oligosaccharides that can act as specific regulatory molecules when released from covalent attachment within cell walls. The authors conclude the paper with a discussion of two other types of structural cell wall polysaccharides that may possess interesting, undiscovered biological rhamnogalacturon I and rhamnogalacturon II.

11952 (CONF-840192—, pp 52-74) **Noncellulosic β-glucans in cell walls.** Stone, B.A. (La Trobe Univ., Victoria, Australia). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Six types of beta-glucans have been found in cell walls of higher plants, fungi, and algae. Cellulose, the ribbon-like beta-glucan with a single monomer and linkage type, is the ubiquitous component of the fibrillar phase of walls of higher plants, as well as certain groups of algae and fungi. The matrix phase beta-glucans from higher plants are related to cellulose, but show structural features which prevent the strong, regular, intra- and intermolecular hydrogen bonding exhibited by cellulose. In this paper, the authors discuss some recent data on the structure and occurrence of (1-3, 1-4)-beta-glucans and (1-3)-beta-glucans in higher plants and make some observations concerning their biosynthesis.

11953 (CONF-840192—, pp 75-88) **Glycoprotein component of plant cell walls.** Cooper, J.B.; Chen, J.A.; Varner, J.E. (Washington Univ., St. Louis, MO). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The primary wall surrounding most dicotyledonous plant cells contains a hydroxyproline-rich glycoprotein (HRGP) component named extensin. A small group of glycopeptides solubilized from isolated cell walls by proteolysis contained a repeated pentapeptide glycosylated by tri- and tetraarabinosides linked to hydroxyproline and, by galactose, linked to serine. Recently, two complementary approaches to this problem have provided results which greatly increase the understanding of wall extensin. In this paper the authors describe what is known about the structure of soluble extensin secreted into the walls of the carrot root cells.

11954 (CONF-840192—, pp 89-119) **Chitin and cellulose fibrillogenesis in vivo and their experimental alteration.** Herth, W.; Hausser, I. (Univ. of Heidelberg, West Germany). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Previous work showed that both chitin micofibril assembly of the chrysoflagellate alga Poterioochromonas and cellulose ribbon assembly of the gram-negative bacterium Acetobacter may be altered by applying the optical brightener white ST(CW) and the cellulose dye Congo Red(CR) to polysaccharides during fibrillogenesis. With this type of experiment, it has been shown that the steps of polymerization and crystallization are not simultaneous, but that they may be experimentally separated. In the present work, the authors propose a model of microfibril orientation which involves the force of crystallization in the movement of synthase aggregates in the plasma membrane (PM). Such orientation of the microfibrils is also disturbed when the normal crystallization process is interrupted by the application of CW or CR. The authors have extended the observations on experimental alteration of microfibril assembly to a variety of other objects, and have applied freeze-fracture to detect possible alterations in the PM particle aggregates postulated to be involved in microfibril formation.

11955 (CONF-840192—, pp 195-221) **Cell wall breakdown and abscission.** Sexton, R.; Burdon, J.M.; Reid, J.S.G.; Durbin, M.L.; Lewis, L.N. (Stirling Univ., Scotland). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

In most of the examples that have been investigated, abscission seems to be the result of wall degradation in a narrow band of cells that bisects the base of the organ to be shed. This process rep-

resents a dramatic example of the dynamic nature of cell wall metabolism. In this paper, a detailed account of the events that occur during leaf abscission of Impatiens sultani Hook is given. Cytochemical observations on the nature of cell wall breakdown and details of the enzymes thought to bring these changes about are described. These and previously published observations are used as a vehicle to review some of the more important aspects of the process.

11956 (CONF-840192—, pp 222-234) **Control of cell wall assembly during differentiation.** Northcote, D.H. (Univ. of Cambridge, England). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The assembly of the plant cell wall outside the protoplast is a complex secretory process. It is controlled at (a) the level where the material is synthesized within the cell, and (b) by the operation of transport mechanisms for movement of material into the endomembrane system. Finally, it is controlled by the subsequent regulation of the directed movement and fusion of vesicles derived from the membranes. The biochemical control can be of two kinds. One of these is continuous monitoring of the flow of synthesis by biochemical feedback control mechanisms of the synthetic metabolic pathways. The other is regulation of the amount and type of enzyme present at any one stage of cell differentiation or development. The authors have used two approaches to investigate the processes of cell wall growth. One of these is to isolate the growing tissue at various stages of differentiation from an intact stem of sycamore or bean so that cambium cells, differentiating xylem cells, and fully differentiated xylem cells are separated from the plant and analyzed separately. The other approach is to use tissue cultures. Nodules of differentiated cells, which contain both phloem and xylem, are induced into the cultures by applying plant growth factors.

11957 (CONF-840192—, pp 235-253) **Cytokinesis, wall development, and morphogenesis in green algal flagellates.** Domozych, D.S. (Skidmore College, Saratoga Springs, NY). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

One of the most outstanding features of green algal flagellates is the rich diversity of extracellular coverings, or envelopes, ranging from the intricately designed scales of the Prasinophyceae to the multilayered, crystalline, glycoprotein-polysaccharide walls of the Chlorophyceae. Cellular morphogenesis and primitive histogenesis are closely associated with covering ontogenesis. This information would elucidate our understanding of subcellular system coordination and subcelluar pattern alteration/diversity in botanical evolution. The aim of this report is to reveal the basic wall/scale-related development patterns and diversity in such patterns, and to highlight the need for future research in this vein.

11958 (CONF-840192—, pp 392-396) **Cell wall development in maize coleoptiles.** Carpita, N.C. (Purdue Univ., West Lafayette, IN). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Coleoptiles are classic tools for the study of cell enlargement in higher plants. Although alterations in the physical properties of the primary wall are responsible for wall expansion during enlargement, the chemical bases for these alterations have not been identified. Changes in the composition of the primary walls of maize coleoptiles were examined during development to yield information on the nature of wall organization in this tissue.

11959 (CONF-840192—, pp 435-443) **Immunocytochemical and cytochemical evidence for an intracellular role for plant Golgi apparatus.** Herman, E.M.; Platt-Aloia, K.A.; Thomson, W.W.; Shannon, L.M. (Univ. of California, Riverside). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The evidence of intracellular roles for the plant Golgi apparatus is limited. Plants do not contain lysosomes although the central vacuole appears to have many of the functional attributes of lysosomes. Little evidence is available for a roles of the Golgi apparatus in the assembly of the vacuole. The specialized vacuoles of legume seed cotyledons, the protein bodies, have been demonstrated to have an enzymatic composition and functional role analogous to that of the animal cell lysosome. A detailed examination of the formation of the protein body produces a model system to test for possible role of the Golgi apparatus in the assembly of a plant lysosomal compartment. In the present paper, the authors present some cytochemical evidence that the Golgi apparatus mediates the transport and deposition of protein body matrix components such as lectins and α-galactosidase as well as the sterols of the protein body membrane.

11960 (CONF-840192—, pp 444-448) **Are cortical microtubules essential for cell formation and cell division by isolated callus protoplasts?.** Hoffmann, F.; Hahne, B.; Hahne, G. (Univ. of California, Irvine). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Protoplasts from a large number of species, or from certain genotypes or special tissues, do not divide and regenerate callus when cultured under standard conditions. The behavior of nonregenerating protoplasts may be attributed to a loss of genetic material or to a physiological block which may have been caused by the enzymatic removal of the cell wall. In this paper, the authors demonstrate that such a physiological block is the arresting factor in hibiscus callus protoplasts. They further report the induction of consecutive divisions in this system by promoting microtubule assembly.

11961 (CONF-840192—, pp 475-476) **Cellulose synthesis inhibition, cell expansion, and patterns of cell wall deposition in Nitella internodes.** Richmond, P.A.; Metraux, J.P. (Univ. of the Pacific, Stockton, CA). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The authors have investigated the pattern of wall deposition and maturation and correlated it with cell expansion and cellulose biosynthesis. The herbicide 2,6-dichlorobenzonitrile (DCB) was found to be a potent inhibitor of cellulose synthesis, but not of cell expansion in Nitella internodal cells. Although cellulose synthesis is inhibited during DCB treatment, matrix substances continue to be synthesized and deposited. The inhibition of cellulose microfibril deposition can be demonstrated by various techniques. These results demonstrate that matrix deposition is by apposition, not by intussusception, and that the previously deposited wall moves progressively outward while stretching and thinning as a result of cell expansion.

11962 (CONF-840192—, pp 483-494) **Control of cell wall formation in pollen tubes: the interaction of dictyosome activity with the rate of tip extension.** Steer, M.W.; Picton, J.M. (Queen's Univ. of Belfast, Ireland). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The plant cell wall consists of a system of microfibrils, composed of cellulose, embedded in a matrix of hemicelluloses and pectins. At the cellular level, it has been known for some time that the elements of the Golgi apparatus, the dictyosomes, are the site of synthesis of the matrix components. The polysaccharides are then transported through the cytoplasm in vesicles which fuse with the plasma membrane, releasing the matrix materials to the cell surface. These materials may then penetrate some distance into the wall. Little is known of the regulation of the amount of material deposited in the wall by these mechanisms. It must be assumed that the dictyosomes form part of a chain of control, governing cell wall formation, since increases and decreases in their activities appear to be related to requirements for wall growth at particular stages of cell development. The authors have used growing pollen tubes of Tradescantia virginiana as a model system to compare dictyosome activities and wall formation at different tip extension rates, so that they could analyze the intracellular control mechanisms for vesicle formation and wall production.

11963 **Densitometric nondestructive microassay for DNA quantitation.** Moore, S.P.; Sutherland, B.M. (Brookhaven National Lab., Upton, NY). *Analytical Biochemistry;* **144**: 15-19(1985).

A nondestructive assay for small quantities of nonradioactive DNA has been developed. Submicroliter volumes of DNA samples of concentrations as low as 10 μg/ml in 10 mM Tris, pH 8, containing 10 μg/ml ethidium bromide are photographed in 1-μl microcapillary tubes on a near-uv transilluminator. The negatives are scanned with a densitometer, producing a sharp peak for each capillary; samples whose peak heights show apparent linearity with DNA content are compared to the linear portion of a standard curve constructed from DNA samples of known concentrations. The samples may be recovered undamaged, as introduction into capillaries and illumination for photography do not introduce nicks into the DNA. The DNA samples may be of heterogeneous molecular weight, but all DNAs should be of similar base composition and in the same buffer. Traces of phenol do not interfere with the determination.

5504 Genetics

11964 (CONF-840192—, pp 344-358) **Gene cloning as an approach to understanding specificity in plant-pathogen systems.** Keen, N.T.; Staskawicz, B.J. (Univ. of California, Riverside). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The practical importance of disease resistance genes in agriculture has spurred efforts to elucidate the biochemical mechanisms underlying gene-for-gene interactions. This paper discusses several biochemical and molecular genetic strategies which curtail pathogen growth. The importance of the molecular cloning of a DNA sequence from a avirulent pathogen that conditions avirulence on the appropriate plant resistance genotype is stressed. Recently, an avirulence gene from race 6 of Pseudomonas syringae pv. glycinea has been cloned which conferred the phenotype of the parent race 6 bacterium when transferred to other bacterial races on a wide host range plasmid.

5505 Metabolism

REFER ALSO TO CITATION(S) 11972

11965 **(BNL—37327) Cation shifts in human retina-choroid.** Panessa-Warren, B.J.; Kraner, H.W.; Jones, K.W.; Kaplan, C. (Brookhaven National Lab., Upton, NY (USA); State Univ. of New York, Stony Brook (USA). Health Science Center). Oct 1985. Contract AC02-76CH00016. 50p. (CONF-8505112—4). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005265.

From 2. international symposium on the biology and toxicology of metals using nuclear analytical methods; Upton, NY, USA (20 May 1985).

Human ocular tissues from 50 donor eyes were elementally and morphologically analyzed in order to correlate the elemental content and distribution of Ca, Ba, Cr, Cu, Zn, and Se with ocular morphology, sex, race, irideal pigmentation, age, time of death, birth weight, presence- and severity- of diabetes, and other pathologies noted at autopsy. Initially, to facilitate the transport of donor tissue to the laboratory, the eyes were fixed in glutaraldehyde. Because our preliminary data revealed alterations in elemental content following chemical fixation of ocular tissues, all of the subsequent samples were analyzed in their fresh, hydrated (unfixed) condition as soon after enucleation as possible. Samples were elementally analyzed by x-ray fluorescence spectrometry (XRF) and proton induced x-ray emission spectrometry (PIXE) using high resolution Si(Li) x-ray detectors. Tissue was morphologically examined by scanning electron microscopy and light microscopy histochemistry. 38 refs., 6 figs., 8 tabs.

11966 **(DOE/PC/30248—T2) Carcinogenic potential of products produced by coal conversion processes. Final technical report.** Kletzien, R.F.; Miller, M.R. (West Virginia Univ., Morgantown (USA)). 4 Dec 1985. Contract FG22-80PC30248. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86003909.

The most important accomplishment reported was to show that human fibroblasts could be used as an indicator of active carcinogens. In addition during the course of these studies the roles of DNA polymerases α, β and γ in DNA repair synthesis were clarified. These studies show for the first time that different DNA polymerases are involved to varying degrees in repairing DNA damaged by different agents. This is a novel and important finding which furthers our understanding of how different types of DNA damage are repaired in animal cells.

11967 **Control of photosynthetic carbon metabolism.** Bassham, J.A. (Lawrence Berkeley Lab., CA). *Science (Washington, D.C.);* **172**: 526-534(7 May 1971).

Strong regulation of photosynthetic metabolism is maintained by controlled key enzymes within the carbon reduction cycle, on biosynthetic paths leading from it, and within the chloroplast membrane. Of these, the most important are ribulose diphosphate carboxylase, controlling the initial entry of carbon dioxide, and fructose diphosphatase, operating as a portal between carbohydrate metabolism and other biosynthesis, and perhaps playing some role in the selective diffusion of sugar phosphates through the outer chloroplast membrane. Intracellular pH and concentrations of magnesium ion and inorganic pyrophosphate seem to be candidates for controlling factors in some of these processes. These and other control effects have been demonstrated by determinations of metabolite concentrations in green cells and chloroplasts in vivo by tracer techniques. Along biosynthetic paths, pyruvate kinase, which controls the conversion of phosphoenolpyruvic acid to pyruvate, and sucrose phosphate synthetase, which controls sucrose synthesis, play important roles. 61 references, 6 figures.

5506 Medicine

REFER ALSO TO CITATION(S) 11717, 11947, 11986, 11999

11968 (CONF-840192—, pp 381-391) **Polymorphy in native cellulose: recent developments.** Atalla, R.H. (Institute of Paper Chemistry, Appleton, WI). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

In a number of earlier studies, the authors developed a model of cellulose structure based on the existence of two stable, linearly ordered conformations of the cellulose chain that are dominant in celluloses I and II, respectively. The model rests on extensive Raman spectral observations together with conformational considerations and solid-state ^{13}C-NMR studies. More recently, they have proposed, on the basis of high resolution solid-state ^{13}C-NMR observations, that native celluloses are composites of two distinct crystalline forms that coexist in different proportions in all

native celluloses. In the present work, they examine the Raman spectra of the native celluloses, and reconcile their view of conformational differences with the new level of crystalline polymorphy of native celluloses revealed in the solid-state ^{13}C-NMR investigations.

11969 (CONF-840192—, pp 419-422) **Endogenous acceptors for polyuronide biosynthesis in Mucor rouxii.** Carreon, A.F.; Balcazar, R. (Universidad de Guanajuato, Mexico). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Cell walls of Mucor rouxii contain relatively high amounts of acidic polymers of D-glucuronic acid. Two types of polyuronides have been isolated from cell walls of M. rouxii: mucoric acid and mucoran. Mucoran isolated from yeast cell walls is a heteropolysaccharide containing D-mannose, D-fructose, D-galactose, and D-glucose, besides D-glucuronic acid. On the other hand, mucoric acid, from sporangiophore walls is a homopolymer of D-glucuronic acid. Glucuronosyl transferase, the enzyme which catalyzes the transfer of glucuronic acid from UDP-glucuronic acid to acidic polymers, has been demonstrated using crude membrane fractions from M. rouxii.

11970 (CONF-840192—, pp 433-434) **Macromolecular organization of xyloglucan and cellulose in pea epicotyls.** Hayashi, T.; Maclachlan, G. (McGill Univ., Montreal, Quebec). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Xyloglucan is known to occur widely in the primary cell walls of higher plants. This polysaccharide in most dicots possesses a cellulose-like main chain with three of every four consecutive residues substituted with xylose and minor addition of other sugars. Xyloglucan and cellulose metabolism is regulated by different processes; since different enzyme systems are probably required for the synthesis of their 1,4-β-linkages. A macromolecular complex composed of xyloglucan and cellulose only was obtained from elongating regions of etiolated pea stems. It was examined by light microscopy using iodine staining, by radioautography after labeling with [^{3}H]fructose, by fluorescence microscopy using a fluorescein-lectin (fructose-binding) as probe, and by electron microscopy after shadowing. The techniques all demonstrated that the macromolecule was present in files of cell shapes, referred to here as cell-wall ghosts, in which xyloglucan was localized both on and between the cellulose microfibrils.

11971 (CONF-840192—, pp 457-463) **Identification of calmodulin released by osmotic shock of maize roots.** Kuzmanoff, K.M. (Stanford Univ., CA). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

Exogenously applied calcium at low concentrations (10 mM and less) stimulates, while higher concentrations (greater than 20 mM) inhibit maize root growth. The phenothiazine calmodulin inhibitors chlorpromazine and trifluoperzine inhibit maize root growth and are reversible by calcium. The loss of acid-inducible growth after osmotic shock indicates that at least part of the complex associated the acid-induced growth is released. Since calmodulin (CaM) is a small protein (mol wt about 17 kD) found to play a pivotal role in Ca^{+2} regulated mechanisms, the material released from maize roots by osmotic shock was examined for the presence of CaM.

11972 (CONF-8510195—2) **Structurally modified fatty acids - clinical potential as tracers of metabolism.** Dudczak, R.; Schmoliner, R.; Angelberger, P.; Knapp, F.F.; Goodman, M.M. (Oak Ridge National Lab., TN (USA); Vienna Univ. (Austria). 1. Medizinische Klinik; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). 1985. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005161.

From Assessment of myocardial metabolism by cardiac imaging symposium; Vienna, Austria (26 Oct 1985).

Recently 15-p-iodophenyl-betamethyl-pentadecanoic acid (BMPPA) was proposed for myocardial scintigraphy, as possible probe of metabolic processes other than β-oxidation. In 19 patients myocardial scintigraphy was done after i.v. BMPPA (2 to 4 mCi). Data were collected (LAO 45°/14; anterior/5) for 100 minutes in the fasted patients. From heart (H) and liver (L) organ to background (BG) ratios were calculated, and the elimination (E) behavior was analyzed from BG (V. cava region) corrected time activity curves. In 10 patients plasma and urine were examined. By $CHCl_3$/MeOH extraction of plasma samples (90 min. pi) both in water and in organic medium soluble catabolites were found. TLC fractionation showed that those were co-migrating, compared to standards, with benzoic acid, BMPPA and triglycerides. In urine (0 to 2h pi: 4.1% dose) hippuric acid was found. It is concluded that BMPPA is a useful agent for myocardial scintigraphy. Its longer retention in the heart compared to unbranched radioiodinated fatty acids may facilitate SPECT studies. Rate of elimination and plasma analysis indicate the metabolic breakdown of BMPPA. Yet, the complexity of the supposed mechanism may impede curve interpretation in terms of specific metabolic pathways. 19 refs., 5 tabs.

11973 (DOE/ER/60040—02) **Chemoradiotherapy of cancer: boronated antibodies and boron-containing derivatives of promazine and porphyrins for neutron capture therapy. Progress report, November 1984-October 1985.** Soloway, A.H.; Barth, R.F. (Ohio State Univ. Research Foundation, Columbus (USA)). Dec 1985. Contract AC02-82ER60040. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004474.

In order to use boron 10 to selectively destroy target cells by boron neutron capture therapy it will be necessary to deliver 10^9 boron-10 atoms to that target cell. To achieve this density two approaches are being used: boron-10 labelled monoclonal antibody and labelling of promazine with carboborane cages. This report describes chemical approaches to labelling with boron of monoclonal antibodies, promazine and chlorpromazine. 25 refs.

11974 (FRNC-TH—1428) **Contribution to regularizing iterative method development for attenuation correction in gamma emission tomography.** Cao, A. (Paris-11 Univ., 91 - Orsay (France)). Jul 1981. 197p. (In French). NTIS (US Sales Only), PC A09/MF A01. File Number DE86750327.

This study is concerned with the transverse axial gamma emission tomography. The problem of self-attenuation of radiations in biologic tissues is raised. The regularizing iterative method is developed, as a reconstruction method of 3 dimensional images. The different steps from acquisition to results, necessary to its application, are described. Organigrams relative to each step are explained. Comparison notion between two reconstruction methods is introduced. Some methods used for the comparison or to bring about the characteristics of a reconstruction technique are defined. The studies realized to test the regularizing iterative method are presented and results are analyzed.

11975 (FRNC-TH—2063) **Optimal regularization methods and their applications for tomography: new performing image reconstruction algorithms.** Girard, D. (Institut National Polytechnique, 38 - Grenoble (France)). Oct 1984. 137p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE86750380.

A new kind of image reconstruction methods is proposed. The approach used is that of optimal regularization method. New reconstruction algorithms are proposed. An application of the proposed algorithms for X-ray tomography, positron tomography and time-of-flight tomography is presented.

11976 (INIS-mf—9626-Vol.1, pp 64-68) **Evaluation of radiation risk resulting from diagnostic procedures that involve radionuclides.** Tomasevic, M.; Simonovic, J.; Radovanovic, R. (Clinical Centre of Medical Faculty, Beograd (Yugoslavia) Inst. of Occupational and Radiobiological Health). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE85781216. (CONF-830995—Vol.1).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

During 1981 in SR Serbia there were performed 72043 diagnostic procedures that involved application of radionuclides. From this quantity it has been selected 71819 of procedures for evaluation of radiation risk. The thyroid has been the most frequently investigated organ. The investigation for thyroid function has been done in 31.46% of cases (^{131}I-sodium iodine) and scintigraphy by application of ^{131}I-sodium iodine in 21.80% and in 0.26% of cases by application of sup(99m)Tc-Pertechnetate. The most frequently applied radionuclides were ^{131}I (sodium iodine and Hippuran - 76.36%) and sup(99m)Tc. Application of sup(99m)Tc has been increased not earlier than the last few years (19.56%). The other radionuclides have been applied in considerable less extent. Using of an extended dose concept of absorbed fractions for evaluation of internal absorbed doses as well the model for evaluation of radiation risk, there have been evaluated the number of malignancy which could occur in observed population because of application of radionuclides in diagnostic purposes. The evaluated number of malignancy resulting from thyroid investigation was found to be 6.128 (0.344 in men and 5.784 in women) and form the investigations of all other organs it was found to be in total 0.403 (0.159 in men and 0.244 in women).

11977 **(INIS-mf—9823) Determination of the left ventricular volumina by computerized tomography, as compared to laevo-angiocardiography.** Rottloff, R. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 2 Dec 1982. 103p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780352.

Cardiac CT, both prior to and after contrast medium injection, according to the current knowledge is a good and informative method of non-invasive volume measurements of the end-diastolic volume of the left ventricle, using the two-axial technique. The correlations made have shown that the evaluation model chosen will allow statistically satisfactory results to be obtained even by non-experienced analysts, and that it hence is a reliable and reproducible method. The evaluation employing planimetry consistently yields results exceeding those of cardiac catheterisation by up to 20 p.c. This difference is even higher in case of cardiomegaly or cardiac wall hypertrophy. The error sources inherent in this method still make end-systolic volume determination less satisfactory, although the results indicate possible ways of optimization. As the determination of stroke volume and output fraction is based on the end-systolic volume measurement, the error sources of this part of the method are taken into account in the evaluation. This explains the low linear correlation which, according to the current state of knowledge, would characterise the method as non-acceptable. Breaking down the case material into various groups of disease results in differently high correlations, due to the different configurations presented by the left ventricle as a consequence of various diseases. The best agreement is obtained in the group of patients suffering from cardiomyopathy.

11978 **(LA-UR—85-4263) Problems associated with dimensional analysis of electroencephalogram data.** Layne, S.; Mayer-Kress, G.; Holzfuss, J. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 12p. (CONF-8509203—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004732.

From International conference on dimensions and entropies in chaotic systems; Pecos River, NM, USA (11 Sep 1985).

The goal was to evaluate anesthetic depth for a series of 5 to 10 patients by dimensional analysis. It has been very difficult to obtain clean EEG records from the operating room. Noise is prominent due to electrocautery and to movement of the patient's head by operating room personnel. In addition, specialized EEG equipment must be used to reduce noise and to accommodate limited space in the room. This report discusses problems associated with dimensional analysis of the EEG. We choose one EEG record from a single patient, in order to study the method but not to draw general conclusions. For simplicity, we consider only two states: awake but quiet, and medium anesthesia. 14 refs., 8 figs., 1 tab.

11979 **(LBL—19667) New Compton densitometer for measuring pulmonary edema.** Loo, B.W.; Goulding, F.S.; Simon, D.S. (Lawrence Berkeley Lab., CA (USA); California Univ., San Francisco (USA). Cardiovascular Research Inst.). Oct 1985. Contract AC03-76SF00098. 9p. (CONF-851009—46). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005212.

From IEEE nuclear science symposium; San Francisco, CA, USA (23 Oct 1985).

Pulmonary edema is the pathological increase of extravascular lung water found most often in patients with congestive heart failure and other critically ill patients who suffer from intravenous fluid overload. A non-invasive lung density monitor that is accurate, easily portable, safe and inexpensive is needed for clinical evaluation of pulmonary edema. Other researchers who have employed Compton scattering techniques generally used systems of extended size and detectors with poor energy resolution. This has resulted in significant systematic biases from multiply-scattered photons and larger errors in counting statistics at a given radiation dose to the patient. We are proposing a patented approach in which only backscattered photons are measured with a high-resolution HPGe detector in a compact system geometry. By proper design and a unique data extraction scheme, effects of the variable chest wall on lung density measurements are minimized. Preliminary test results indicate that with a radioactive source of under 30 GBq, it should be possible to make an accurate lung density measurement in one minute, with a risk of radiation exposure to the patient a thousand times smaller than that from a typical chest x-ray. The ability to make safe, frequent lung density measurements could be very helpful for monitoring the course of P.E. at the hospital bedside or outpatient clinics, and for evaluating the efficacy of therapy in clinical research. 6 refs., 5 figs.

11980 **In vivo measurement of lithium in the body by a neutron activation analysis technique.** Glaros, D.; LoMonte, A.F.; Ellis, K.J.; Yasumura, S.; Stoenner, R.W.; Cohn, S.H. (Medical Department, Brookhaven National Laboratory, Upton, New York 11973). *Medical Physics;* **13**: No. 1, 45-49(Jan 1986). Contract AC02-76CH00016.

A technique has been developed for in vivo determination of lithium content in the head (and potentially in the whole body and in selected organs) of patients undergoing lithium therapy. It is based on the measurement of tritium induced by the ^{6}Li(n,α)T nuclear reaction after neutron irradiation of the body. The fraction of tritium exhaled in the expired air in the form of HT is collected, separated from the other gases, and counted in a high-sensitivity beta counter. The feasibility of the technique was demonstrated by measurements of lithium in the head of a sheep and in the whole body of rats, following the administration of ^{6}LiCl (enriched ^{6}Li isotope, 95.46% abundancy). The precision of the technique is acceptable for clinical applications based on a maximum propagated error of 8.4%. The sensitivity is 1 count/d (from T activity) per 10 mSv (total dose) and 1 μg of ^{6}Li. This indicates that studies on patients under ^{6}Li treatment can be performed successfully with a radiation dose to the head of 1—2 mSv.

11981 **Microanalytical techniques for boron analysis using the ^{10}B(n,α)^{7}Li reaction.** Fairchild, R.G.; Gabel, D.; Laster, B.H.; Greenberg, D.; Kiszenick, W.; Micca, P.L. (Medical Department, Brookhaven National Laboratory, Upton, New York 11973). *Medical Physics;* **13**: No. 1, 50-56(Jan 1986). Contract AC02-76CH00016.

In order to predict the efficacy of boronated compounds for neutron capture therapy (NCT), it is mandatory that the boron concentration in tissues be known. Various techniques for measurement of trace amounts of boron (1—100 ppm) are available, including chemical and physical procedures. Experience has shown that, with the polyhedral boranes and carboranes in particular, the usual colorimetric and spark emission spectroscopic methods are not reliable. Although these compounds may be traced with additional radiolabels, direct physical detection of boron by nondestructive methods is clearly preferable. Boron analysis via detection of the

prompt-γ ray from the $^{10}B(n,\alpha)^{7}Li$ reaction has been shown to be a reliable technique. Two prompt-γ facilities developed at Brookhaven National Laboratory are described. One, at the 60-MW high flux beam reactor, uses sophisticated beam extraction techniques to enhance thermal neutron intensity and reduce fast neutron and γ contamination. The other was constructed at Brookhaven's 5-MW medical research reactor and uses conventional shielding and electronics to provide an "on-line" boron analysis facility adjacent to beams designed for NCT, thus satisfying one of the requisites for clinical application of this procedure. Technical restrictions attendant upon the synthesis and testing of boronated biomolecules often require the measurement of trace amounts of boron in extremely small (mg) samples. A track-etching technique capable of detecting ng amounts of boron in mg liquid or cell samples is described. Thus it is possible to measure the boron content in small amounts (mg samples) of antibodies, or boron uptake in cells grown in tissue culture.

11982 **Tin-117M-labeled stannic (SN^{4+}) chelates.** Srivastava, S. C.; Meinken, G. E.; Richards, P. (to The United States of America as represented by the United States Department of Energy). US Patent 4,533,541. 6 Aug 1985. Filed date 25 Aug 1983. vp.

PAT-APPL-526251.

The radiopharmaceutical reagents of this invention and the class of Tin-117m radiopharmaceuticals are therapeutic and diagnostic agents that incorporate gamma-emitting nuclides that localize in bone after intravenous injection in mammals (mice, rats, dogs, and rabbits). Images reflecting bone structure or function can then be obtained by a scintillation camera that detects the distribution of ionizing radiation emitted by the radioactive agent. Tin-117m-labeled chelates of stannic tin localize almost exclusively in cortical bone. Upon intravenous injection of the reagent, the preferred chelates are phosphonate compounds, preferable, PYP, MDP, EHDP, and DTPA. This class of reagents is therapeutically and diagnostically useful in skeletal scintigraphy and for the radiotherapy of bone tumors and other disorders.

5507 Microbiology

REFER ALSO TO CITATION(S) 11129, 11705, 11894, 11926

5508 Morphology

REFER ALSO TO CITATION(S) 11952, 11953, 11957, 12020

11983 (CONF-840192—, pp 185-194) **Regulation of cell wall mechanical properties in vivo and in vitro.** Taiz, L.; Richmond, P.A. (Univ. of California, Santa Cruz). 1984. American Society of Plant Physiologists, P.O. Box 1688, Rockville, MD 20850. File Number TI85009403.

From 7. annual symposium in botany - structure, function and biosynthesis of plant cell walls; Riverside, CA, USA (12 Jan 1984).

The rate of plant cell expansion is controlled by the osmotic gradient between the cells and its external environment and by the mechanical properties of the cell wall. In Nitella, growth rate is regulated by changes in Pc, the critical turgor pressure. During a turgor step-down, growth is inhibited initially, but slowly recovers without a compensatory increase in turgor pressure. A step-up in turgor following the step-down causes a disproportionately large increase in the growth rate, which rapidly reverts to the steady-state rate. This growth burst during a step-up in turgor presumably reflects, and is proportional to, wall-softening during the previous turgor stepdown. In this paper, the authors report on the effects of pH on the wall softening process during a turgor step-down, and the influence of acid on the kinetics of in vitro extension. The results support a central role for protons in Pc-lowering during a turgor step-down and in biochemical creep during growth.

5509 Pathology

REFER ALSO TO CITATION(S) 11989

11984 **(AD-A—158046/3/XAB) Radiometric methods for rapid diagnosis of viral infection. Annual report, 1 February 1976-31 January 1977.** Wagner, H.N.; Tsan, M.F. (Johns Hopkins Univ., Baltimore, MD (USA)). 22 Nov 1976. 21p. NTIS, PC A02/MF A01.

Two radiometric techniques were investigated for monitoring the effect of Herpes simplex virus on the deoxyribonucleic acid synthesis of monolayers of human embryonic lung fibroblasts. DNA synthesis of infected and uninfested cells was monitored by ^{3}H-thymidine incorporation measured by liquid scintillation counting or by ^{125}I-iododeoxyuridine (^{125}I-IdU) incorporation measured nondestructively by gamma scintillation counting. Radiometric results were compared to those obtained from visual examination for cytopathic effects in the same cell line. Herpes simplex virus Type-2 (HSV-2, 10 to the 6.8th power TCID50) infected cells showed a marked increase in 3H-thymidine incorporation 2-6 hr after infection. HSV-2 and Herpes simplex Type 1 (HSV-1) exhibited similar levels of sensitivity with increased incorporation being observed 72 hr after infection with 10 virions. The ^{3}H-thymidine technique was utilized to assay HSV-1 infected mouse brains. Increased ^{125}I-IdU incorporation was observed 6 hr after infection with 10 to the 5th power to 10 to 6.8th power HSV-1 virions, 24 hr with 10,000 virions, 48 hr with 1000 virions, and 72 hr with 10-100 virions. The increased ^{125}I-IdU incorporation was completely inhibited by preneutralization with immune serum. These radiometric techniques for detection of the viral effect on cellular metabolism are simple, objective, and quantitative.

11985 **(LBL—20560) Two-dimensional diffusion limited system for cell growth.** Hlatky, L. (Lawrence Berkeley Lab., CA (USA)). Nov 1985. Contract AC03-76SF00098. 74p. NTIS, PC A04. File Number DE86005381.

A new cell system, the "sandwich" system, was developed to supplement multicellular spheroids as tumor analogues. Sandwiches allow new experimental approaches to questions of diffusion, cell cycle effects and radiation resistance in tumors. In this thesis the method for setting up sandwiches is described both theoretically and experimentally followed by its use in x-ray irradiation studies. In the sandwich system, cells are grown in a narrow gap between two glass slides. Where nutrients and waste products can move into or out of the local environment of the cells only by diffusing through the narrow gap between the slides. Due to the competition between cells, self-created gradients of nutrients and metabolic products are set up resulting in a layer of cells which resembles a living spheroid cross section. Unlike the cells of the spheroid, however, cells in all regions of the sandwich are visible. Therefore, the relative sizes of the regions and their time-dependent growth can be monitored visually without fixation or sectioning. The oxygen and nutrient gradients can be "turned off" at any time without disrupting the spatial arrangement of the cells by removing the top slide of the assembly and subsequently turned back on if desired. Removal of the top slide also provides access to all the cells, including those near the necrotic center, of the sandwich. The cells can then be removed for analysis outside the sandwich system. 61 refs., 17 figs.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 10937, 11934, 11950, 11978, 12018

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 11964, 12011

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 11985

11986 **(AD-A—157717/0/XAB) Armed Forces Radiobiology Research Institute annual research report, Fiscal Year 1984.** (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 1984. 75p. (ARR—18). NTIS, PC A04/MF A01.

This report contains information on the following for the period 1 October 1983 through 30 September 1984: the overall biomedical research program in the Defense Nuclear Agency, categories of research effort in military radiobiology, the status of in-house research at AFRRI, the contract research program at the Defense Nuclear Agency, interaction of AFRRI and the North Atlantic Treaty Organization, and Memoranda of Understanding.

11987 **(AD-A—157791/5/XAB) Comparison of Schistosoma mansoni migration patterns in normal and irradiated cercaria-immunized mice by means of autoradiographic analysis. Evidence that worm elimination occurs after the skin phase in immunized mice.** Dean, D.A.; Mangold, B.L.; Georgi, J.R.; Jacobson, R.H. (Cornell Univ., Ithaca, NY (USA)). Jan 1984. 9p. NTIS, PC A02/MF A01.

Migration and elimination of radiolabeled Schistosoma mansonic were compared in normal and irradiated cercaria-immunized mice by autoradiogrpahy of compressed host tissues. The results indicated that 1) most of the normal elimination of schistosomula in unimmunized mice and the additional elimination in immunized mice occur at some point(s) after arrival of schistosomula in the lungs and before their development into adult worms, 2) migration of schistosomula from skin to lungs is delayed for several days but not reduced in immunized mice, 3) migration of schistosomula from lungs to liver is delayed for several days in immunized mice and 4) schistosomula reach the liver in reduced numbers or are killed and cleared in the liver in greater numbers in immunized mice. The lung chop procedure was shown to recover schistosomula from control and irradiated cercaria-immunized mice with equal efficiency. Autoradiography of all tissues of the body demonstrated that, in both control and immunized mice, at least 20-25% of the schistosomula detectable 2 and 3 weeks after infection were present in tissues other than the skin, lungs and liver.

11988 **(AD-A—157825/1/XAB) Effects of irradiation on frozen corticocancellous bone allograft incorporation and immunogenicity. Final report.** Pellet, S.; Strong, D.M.; Temesi, A.; Matthews, J.G. (Naval Medical Research Inst., Bethesda, MD (USA)). 1983. 11p. (NMRI—83-122). NTIS, PC A02/MF A01.

Although irradiation has been associated with deleterious effects on preserved bone graft in animals in the past, no report has suggested improvement in graft healing. The decrease in immunogenicity of frozen specimens associated with irradiation is not surprising, since high doses of electron bombardment can be expected to either break or cross-link any polymer. Such changes in the primary and tertiary structuring would be expected to affect their ability to elicit an immune response. Partial denaturation of protein moieties located on the cell or in the extracellular matrix could conceivably produce antigens that could be recognized by the host and cause immunologically mediated disease or graft failure in the host. Evidence that such a process occurs has not been seen. Improvement in the graft healing characteristics was noted in irradiated specimens in the same dose range that was noted to cause a decrease in the graft's immunogenicity.

11989 **(AD-A—157826/9/XAB) Immunologic and hematologic perturbations in models of combined injury.** Gruber, D.F.; MacVittie, T.J.; Pavlovskis, O.R.; Walker, R.I.; Conklin, J.J. (Naval Medical Research Inst., Bethesda, MD (USA)). 1985. 11p. (NMRI—85-25). NTIS, PC A02/MF A01.

Many aspects of the reports in the literature describing anergic conditions that exist post trauma are confirmed by data gathered by the Armed Forces Radiobiology Research Institute in a comprehensive program to study combined-injury effects. Dealing with one aspect of this study, this article discusses the synergism of trauma and illness coincident with such stressors as whole-body irradiation, thermal injury, and sepsis. Experimentally produced sepsis depresses and delays both cellular and humoral response patterns in canine and murine modeling systems. Lymphoid populations, dependent on the time of collection post trauma and the organ source, may present an initially augmented response pattern, which within 48 hours becomes depressed to below-normal levels. In addition, immunologic anergy can be induced by the presence of bacterial products such as exotoxin-A. Further mechanisms and regimens of prophylactic immunomodulation are under investigation.

11990 **(AD-A—157885/5/XAB) Recovery of aerobic and anaerobic bacteria from irradiated mice.** Brook, I.; MacVittie, T.J.; Walker, R.I. (Naval Medical Research Inst., Bethesda, MD (USA)). Oct 1984. 3p. (NMRI—84-91). NTIS, PC A02/MF A01.

Anaerobic and aerobic bacteria were often found as mixed infections in 225 lethally irradiated mice. Of a total of 57 mice that were sacrificed, aerobic bacteria were recovered exclusively in 9 (27%) of the 34 culture-positive mice, anaerobic bacteria were recovered exclusively in 15 (44%), and mixed aerobic and anaerobic flora were recovered in 10 (29%). The predominant organisms were anaerobic cocci Escherichia coli, Proteus mirabilis, Staphylococcus spp., and bacteroides spp.

11991 **(AD-A—157984/6/XAB) Sterilization of human bone by irradiation. Final report.** Bright, R.W.; Smarsh, J.D.; Gambill, V.M. (Naval Medical Research Inst., Bethesda, MD (USA)). 1983. 12p. (NMRI—83-121). NTIS, PC A02/MF A01.

Over the years, irradiation sterilization has been the most widely used sterilization method and one of the most acceptable methods of decontaminating human tissue. It is the purpose of chapter to discuss what is known about the methodology of irradiation sterilization as well as to identify its limitations. In this introduction, it is also appropriate to acknowledge that a great deal has yet to be learned about the biology of irradiation sterilization as well as the biology of tissue graft incorporation subsequent to irradiation exposure.

11992 **(AD-A—158066/1/XAB) Murine immunization by cesium-137 irradiation attenuated Schistosoma mansoni cercariae.** Stek, M.; Minard, P.; Cruess, D.F. (Naval Medical Research Inst., Bethesda, MD (USA)). 1984. 6p. (NMRI—84-89). NTIS, PC A02/MF A01.

Cesium-137, becoming a more readily available ionizing gamma-radiation source for laboratory use, was shown to effectively attenuate Schistosoma mansoni cercariae for vaccine production. In parallel comparison studies with the murine model, cesium-137 attenuated cercariae consistently afforded better ($P > 0.05$) protection than did the cobalt-60 prepared vaccine. Dose-response data indicated that the optimal total irradiation with cesium-137 was between 45 and 50 krad.

11993 (INIS-mf—9626-Vol.1, pp 250-257) **Stochastic lung dose modelling. A joint Austrian-Hungarian project.** Hofmann, W.; Daschil, F. (Salzburg Univ. (Austria). Inst. fuer Allgemeine Biologie, Biochemie und Biophysik); Koblinger, L.; Feher, J.; Balashazy, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE85781216. (CONF-830995—Vol.1).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

Large inter- as well as intra-subject variabilities have been observed in all morphological and physiological parameters involved in lung dosimetry. Anatomical data on human lungs were analyzed to define probability distributions of airway diameters, lengths and branching angles. Experiments with radioactive-labelled aerosols were conducted to study particle deposition in bifurcation tubes. Preliminary stochastic dose calculations for inhaled radon decay products yielded highly skewed basal cell dose distributions which can be approximated in most cases by lognormal distributions.

11994 (INIS-mf—9626-Vol.2, pp 13-17) **Some experiences in incidental internal contamination monitoring and dose assessment.** Andrasi, A.; Belezany, E. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1984. NTIS (US Sales Only), PC A13/MF A01. File Number DE85781217. (CONF-830995—Vol.2).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

In the course of routine and special internal contamination monitoring of occupationally exposed workers by whole body counting, among others also low level contaminations of ^{46}Sc, ^{57}Co, $^{133}sup(m)Te$, ^{137}Cs, ^{192}Ir and ^{203}Hg were found. In few cases whole body retention patterns or individual biological half lives could be determined. The received doses were estimated using individual parameters and compared to those derived from the recent ICRP recommendations.

11995 (INIS-mf—9822) **Chromosome investigations on persons whose mothers have been treated with ionizing radiations during pregnancy.** Hanebuth, P. (Kiel Univ. (Germany, F.R.). Medizinische Fakultaet). 20 Sep 1982. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE86780351.

This thesis reports on chromosome investigations on seven persons between 2 and 26 years of age who, during their prenatal life, have been exposed to ionizing radiation. The metaphase chromosomes from peripheral lymphocytes, obtained by standard cytogenic methods, have been scanned for numerical and structural aberrations after a culture period of two or three days. Comparison with non-irradiated specimens revealed a summarily slight increase in the occurrence of some structural aberrations in the irradiated material. The differences are smaller in number than the rate of deviation to be accounted to culturing techniques so that one cannot deduce a radiation-induced impairment from these results. As one of the persons investigated has been undergoing longterm therapy with anticonvulsive drugs, this case is discussed separately. In another case, new staining methods (G, C, or Q-bands) together with an investigation of material from the father, revealed a particularly small Y-chromosome.

11996 (INIS-mf—9824) **Comparative studies of the dose-response relationship of radiation-induced chromosomal aberrations in human lymphocytes induced by low radiation doses, using Feulgen orcein glacial acetic acid and FPG staining.** Wagner, R. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 25 Nov 1982. 59p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE86780353.

Peripheral lymphocytes were exposed in vitro to 220 kV X-radiation, with doses of 0.05, 0.1, 0.2, 0.4, and 0.5 Gy, their culture and preparation was made under standardized conditions. The slides were stained using two different methods, namely FPG staining (fluorescence plus giemsa), and the conventional Feulgen orcein glacial acetic acid method. Compared to the conventional method, FPG staining achieved absolute yields of acentric fragments three times higher, and of dicentric chromosomes twice as high. A linear dose-response relationship in acentric fragments was found by the two staining methods alike, which agrees with the theory. Both staining methods revealed a linear-square dose-response relationship in dicentric chromosomes. Using FPG staining, preparing only M_1 cells for evaluation, the linear component was found to be dominant over the whole dose range applied. The conventional method, analysing M_1 and M_2 cells, revealed the square component to be the most important one. The dose-response relationships determined after FPG staining can be used for biological dosimetry. Calibration can be improved by increasing the number of cells analysed at doses $<=0.1$ Gy.

11997 (NUREG/CR—4214) **Health effects model for nuclear power plant accident consequence analysis. Part I. Introduction, integration, and summary. Part II. Scientific basis for health effects models.** Evans, J.S.; Moeller, D.W.; Cooper, D.W. (Harvard Univ., Boston, MA (USA). School of Public Health). Jul 1985. Contract AC04-76DP00789. 353p. (SAND—85-7185). NTIS, PC A16/MF A01 - GPO. File Number TI85017968.

Analysis of the radiological health effects of nuclear power plant accidents requires models for predicting early health effects, cancers and benign thyroid nodules, and genetic effects. Since the publication of the Reactor Safety Study, additional information on radiological health effects has become available. This report summarizes the efforts of a program designed to provide revised health effects models for nuclear power plant accident consequence modeling. The new models for early effects address four causes of mortality and nine categories of morbidity. The models for early effects are based upon two parameter Weibull functions. They permit evaluation of the influence of dose protraction and address the issue of variation in radiosensitivity among the population. The piecewise-linear dose-response models used in the Reactor Safety Study to predict cancers and thyroid nodules have been replaced by linear and linear-quadratic models. The new models reflect the most recently reported results of the follow-up of the survivors of the bombings of Hiroshima and Nagasaki and permit analysis of both morbidity and mortality. The new models for genetic effects allow prediction of genetic risks in each of the first five generations after an accident and include information on the relative severity of various classes of genetic effects. The uncertainty in modeloling radiological health risks is addressed by providing central, upper, and lower estimates of risks. An approach is outlined for summarizing the health consequences of nuclear power plant accidents. 298 refs., 9 figs., 49 tabs.

11998 (NUREG/CR—4297) **Extremity monitoring: considerations for use, dosimeter placement, and evaluation.** Reece, W.D.; Harty, R.; Brackenbush, L.W.; Roberson, P.L. (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 109p. (PNL—5509). NTIS, PC A06/MF A01 - GPO. File Number TI86004937.

Various aspects of extremity dosimetry are presented in this paper to help the licensee decide when to use extremity dosimetry, what method of dosimetry to use, and how to interpret the results of the dosimetry system. Topics addressed include a review of the applicable regulations and recommendations and their historical basis, a review of the published research relating to extremity dosimetry, a report of laboratory measurement results, and a report of measurements at licensee facilities. The current regulations as they apply to extremity dosimetry and the Nuclear Regulatory Commission's (NRC's) interpretation of these regulations are reviewed. The history of the current Code of Federal Regulations is examined so that the reasoning behind the present regulations may be understood. The recommendations of various radiation advisory groups are also summarized, and a critical review of published experimental data applicable to extremity dosimetry is presented. These recommendations and data are used to identify the radiosensitive tissues in the extremities and rank the relative risk to each organ or tissue.

11999 **(PB—85-242311/XAB) Annual report of the Division of Life Sciences (formerly Division of Risk Assessment). Fiscal year 1983. Report for 1 October 1982-30 September 1983.** (Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health). Jun 1985. 84p. (HHS/PUB/FDA—85-8242). NTIS, PC A05/MF A01.

The Division of Life Sciences, Office of Science and Technology, Center for Devices and Radiological Health, plans, conducts, and supports studies of health effects of both ionizing and nonionizing radiation, including x rays, radiopharmaceuticals, microwaves, ultraviolet light, and ultrasound. Through workshops, symposia, research, and literature review, the division studies and evaluates experimental, epidemiologic, and clinical research to assess health effects resulting from exposure to radiation. This report gives an account of work completed and in progress in the subject period in support of health-related radiation research and evaluation, particularly as it concerns the biologic effects of exposure to electronic products.

12000 **(PNL-SA—13453) Factors affecting the assessment of lung depositions of transuranics.** Swinth, K.L.; Traub, R.J.; Murphy, B.L.; Palmer, H.E. (Pacific Northwest Labs., Richland, WA (USA)). Oct 1985. Contract AC06-76RL01830. 16p. (CONF-8509212—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004866.

From 2. international workshop on lung dosimetry; Cambridge, England (2 Sep 1985).

Techniques permitting accurate and rapid quantitation of internal deposits of heavy elements such as plutonium are essential in order to protect the health and safety of personnel working with these materials. Measurement of plutonium in-vivo by counting the L X-rays from its uranium daughter provides a direct method of assessing depositions. However, the intensity of X-rays (average energy 17 keV) detected externally is influenced by factors such as chest wall thickness, isotopic composition of the plutonium, and tissue distribution. Other factors, such as background radiations and surface contamination, will also influence the accuracy of assessments. The influence of these factors on the assessment of internal depositions is examined in light of recent intercalibration experiments and studies on the tissue distribution of inhaled materials. From these data, the magnitude of the individual errors is estimated along with the overall accuracy. 30 refs.

12001 **(PNL-SA—13561) Introduction to the USUR data.** Kathren, R.L. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1985. Contract AC06-76RL01830. 9p. (CONF-8511121—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004872.

From Department of Energy (DOE) uranium workshop; Rockville, MD, USA (5 Nov 1985).

This single case clearly illustrates the potential value of postmortem radioassay of tissues with regard to our understanding of uranium biokinetics and distribution in tissues, and for application to dosimetry, retrospective of analysis of exposure, and to establishment, verification and refinement of safety standards for uranium. 3 tabs.

12002 **Internal emitter limits for iodine, radium and radon daughters.** Schlenker, R.A. (Argonne National Lab., IL). pp 131-181 of Some issues important in developing basic radiation protection recommendations. Bethesda, MD; National Council on Radiation Protection and Measurements (1985). (CONF-840461—).

From 20. annual meeting of the National Council on Radiation Protection and Measurements; Washington, DC, USA (4 Apr 1984).

This paper opens with statements on basic and secondary radiation limits. The term, direct approach, and ones related to it, are then defined and applied to the limitation of risk from stochastic effects. Non-stochastic data for specific internal emitters (I-131 and radium isotopes) are presented. The paper ends with a discussion of issues. Emphasis is placed on the quantitative aspects of the limit-setting problems. 65 references, 2 figures, 11 tables.

12003 **Dosimetric aspects.** Thomas, R.H. (Univ. of California, Berkeley). pp 182-222 of Some issues important in developing basic radiation protection recommendations. Bethesda, MD; National Council on Radiation Protection and Measurements (1985). (CONF-840461—). Contract AC03-76SF00098.

From 20. annual meeting of the National Council on Radiation Protection and Measurements; Washington, DC, USA (4 Apr 1984).

This paper discusses some aspects of the historical development of the concept of dose equivalent; describes some of the practical problems which have been identified in the determination of dose equivalent for neutrons; discusses some of the ongoing work in the ICRU and ICEP, and, finally, comments briefly on the implications for dosimetry of a risk system in radiation protection. 125 references, 11 figures, 4 tables.

12004 **Scientific Committee 71 on radiation exposure and potentially-related injury.** Bond, V.P. (Brookhaven National Lab., Upton, NY). pp 312-314 of Some issues important in developing basic radiation protection recommendations. Bethesda, MD; National Council on Radiation Protection and Measurements (1985). (CONF-840461—).

From 20. annual meeting of the National Council on Radiation Protection and Measurements; Washington, DC, USA (4 Apr 1984).

A report entitled "The Probability That a Specific Exposure and a Specified Cancer Are Causally Related" is briefly discussed. The report describes radiation risk in terms of probability of causation (PC) and deals extensively with uncertainties associated with the calculation. These uncertainties include those having to do with dose, the risk coefficients, particularly at low doses, and the baseline cancer rate which can vary from locality to locality. The use of the PC approach under the present tort system may not be appropriate.

12005 **Analysis of various aspects of atomic bomb dose estimation at RERF using data on acute radiation symptoms.** Gilbert, E.S.; Ohara, J.L. (Pacific Northwest Lab., Richland, WA). *Radiation Research;* **100**: 124-138(1984). Contract AC06-76RL01830.

The dose-response curves for acute radiation symptoms reported by atomic bomb survivors are compared by dose estimation method (the method used to calculate the transmission factor), shielding category, and city. Circular symmetry is also investigated. It is found that response rates for acute symptoms differ considerably by dose estimation method and shielding category even after controlling for both γ and neutron exposure as well as for city, sex, and age at the time of the bomb. One explanation of these results is that the doses of survivors in Japanese type houses estimated by the nine parameter method are subject to less random measurement error, while doses of those survivors who were in the open and shielded by terrain, who were totally shielded by concrete buildings, and who were in factories are subject to especially large random errors. The degree to which systematic bias contributes to these differences could not be determined. These results have important implications for comparisons between cities since Nagasaki includes a far greater proportion of survivors in shielding categories showing weak dose-response relationships than does Hiroshima. The hypothesis that doses might be higher in the westerly direction in Hiroshima is not supported by acute effects analyses, but excess acute effects are found in the north of Hiroshima.

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 10812, 10812, 10919, 10920, 10920, 10920, 10921, 10922, 10928, 10928, 11870, 11871, 11917, 11965, 11978

12006 **(CONF-851068—4) Detoxication mechanisms of benzo(a)pyrene as studied in the CHO/HGPRT assay.** Recio, L.; Hsie, A.W. (Kentucky Univ., Lexington (USA). Graduate Center for Toxicology; Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004778.

From 10. international symposium on polynuclear aromatic hydrocarbons; Columbus, OH, USA (21 Oct 1985).

We have investigated the biological effects of glucuronide and glutathione conjugation on BaP-induced cytotoxicity and mutagenicity. Our studies demonstrate that glucuronide conjugation of BaP results in a reduction of cytotoxicity without affecting mutagenicity. This is likely due to an elimination of cytotoxic phenols and quinones without affecting the formation and bioactivation of BaP 7,8-diol to the ultimate mutagenic form of BaP. GSH conjugation of BaP catalyzed by GSHTs inhibits the cytotoxicity and mutagenicity of BaP 7,8-diol in a concentration-dependent manner. These are consistent with and supported by biochemical studies on the biotransformation of BaP and DNA binding by bioactivated BaP. We conclude that these two enzyme systems have overlapping and complimentary roles in the detoxication of BaP. The activity of these enzyme systems in vivo can profoundly affect the biological activity of BaP and other PAH. 13 refs., 3 figs., 2 tabs.

12007 **(DOE/ER/60154—1) Biochemical studies on the mechanism of benzo(a)pyrene binding to cellular macromolecules. Progress report.** Litman, G. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1985. Contract AC02-83ER60154. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004502.

This research is directed at eleucidiating the effect of covalently bound benzo(a)pyrene to histone 3 (H3) on the interaction of histone 3 with other histones and DNA. Conditions were optimized for maximum binding of +- anti[G⁻³H] benzo(a)pyrene ⁻7,8 diol⁻9,10- epoxide(BP-diol-epoxide). BP-diol-epoxide binding to non histone chromosomal proteins has also been studied.

12008 **(INFO—0143) Toxicity levels to humans during acute exposure to hydrogen fluoride.** Halton, D.M.; Dranitsaris, P.; Baynes, C.J. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Nov 1984. 66p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86700473.

A literature review was conducted of the acute toxicity of hydrogen fluoride (HF) with emphasis on the effects of inhalation of gaseous HF. The data and findings of the relevant references were summarized under four categories: animal studies, controlled human studies, community exposure and industrial exposure. These were critically reviewed and then lethal concentration-time relationships were developed for humans, corresponding to LCsub(LO), LCsub(10) and LCsub(50) levels. The effects of age, health and other physiological variables on the sensitivity to HF were discussed, as well as antagonistic and synergistic effects with other substances.

12009 **(ORNL/M—82) Acidic deposition: effects on agricultural crops. Final report, April 1980-31 December 1984.** Shriner, D.S.; Johnston, J.W. Jr.; Taylor, G.E. Jr.; Luxmoore, R.J.; McConathy, R.K.; McLaughlin, S.B.; Heagle, A.S.; Norby, R.J.; Takemoto, B.K.; Dubay, D.T. (Oak Ridge National Lab., TN (USA)). May 1985. Contract AC05-84OR21400. 145p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86004943.

The report presents the results of research on soybean response to simulated wet and dry deposition, and field studies of growth, yield, and physiological response to a characterized air quality. Separate abstracts have been prepared for individual papers. (ACR)

12010 **Retention of ingested latex particles in Peyer's patches of germ-free and conventional mice.** Lefevre, M.E.; Joel, D.D.; Schidlovsky, G. (Brookhaven National Lab., Upton, NY). *Proceedings of the Society for Experimental Biology and Medicine;* **179**: No. 4, 522-528(Sep 1985). Contract AC02-76CH00016.

Conventional and germ-free mice ingested a suspension of 2-μm latex particles in drinking water for a 15-day period. Number and distribution of intestinal Peyer's patches did not differ significantly in the two types of mice. Cleared Peyer's patches were compared with regard to size and particle content. The location of particles within Peyer's patch follicles of germ-free mice was similar to that of conventional mice, but the latter had significantly larger follicles and greater accumulations of latex particles. Latex concentration varied with patch location. Proximal patches contained the majority of particles in germ-free mice, whereas particles were most abundant in distal patches of conventional mice. The results show that particle uptake into Peyer's patches takes place even in the complete absence of bacteria in the gut.

12011 **Mutagen formation in a model beef boiling system. III. Purification and identification of three heterocyclic amine mutagens-carcinogens.** Taylor, R.T.; Fultz, E.; Knize, M. (Lawrence Livermore National Lab., CA). *Journal of Environmental Science and Health, Part A: Environmental Science and Engineering;* **A20**: No. 2, 135-148(1985). Contract W-7405-ENG-48.

An extensively boiled supernatant$_2$ (S_2) fraction from beef round steak contains two major Salmonella frameshift mutagens, designated as HPLC peaks A and B. These same mutagens arise, but in different proportions, when S_2 is boiled with creatine phosphate (CP), and they are produced in much greater quantities from a boiled mixture of S_2 + L-tryptophan (Trp) + CP + $FeSO_4$ (S_2/sup */). A third mutagen, peak C, is also generated in the S_2/sup */ mixture. Mutagen peaks A, B, and C were purified to homogeneity and shown by their absorption spectra, mass fragmentation patterns, and other data to be 2-amino-3-methylimidazo[4,5-f]quinoline (IQ), 3-amino-1-methyl-5H-pyrido[4,3-b]-indole (Trp-P-2), and 3-amino-1,4-dimethyl-5H-pyrido[4,3-b]indole (Trp-P-1), respectively. This is the first demonstration that IQ, Trp-P-2, and Trp-P-1 can form under aqueous conditions at 100°C from reactions between low molecular weight precursors that are present in meat juice. Further simplification of and studies with the S_2 fraction of beef muscle should provide relevant information about the mechanisms of frameshift mutagen formation during the cooking of meats and fish.

12012 **Essential trace metals in man: molybdenum.** Schroeder, H.A.; Balassa, J.J.; Tipton, I.H. (Dartmouth Medical School, Hanover, NH). *Journal of Chronic Diseases;* **23**: 481-499(1970).

A survey of human exposures to molybdenum, a trace metal essential for almost all forms of life, was made by analyzing human tissues of 381 subjects from around the world by emission spectroscopy, and foods and beverages by a colorimetric method. Molybdenum was present in all human livers, kidneys and adrenals examined. Total body content of US subjects was less than 9 mg and most organs and tissues contained little. Unlike other essential trace metals, mean concentrations of molybdenum in liver and kidneys were relatively low in the newborn, rising to a peak in the second decade of life and declining slightly thereafter. Mean hepatic and renal concentrations of US and foreign subjects were similar, but the latter had more molybdenum and it occurred more frequently in other organs and tissues. Only a few correlations of molybdenum with other trace metals in tissues were significant. The daily intake of molybdenum in standard diets was about 350 μg. Fish and animal meats supplied variable amounts; legumes, whole grains and their products supplied the majority. Plant foods high in purines were usually high in molybdenum, whereas most vegetables had little or none. Molybdenum in wheat was depleted in refining to white flour; that in sugar was concentrated in molasses and syrups. Rats fed a diet low in molybdenum had higher serum uric acid levels than those given added molybdenum. There is evidence that dental cavities may be prevented by a high intake of molybdenum. It is possible that renal xanthine calculi may result from low intakes and that molybdenum may somehow be involved in disturbances of uric acid metabolism. 45 references.

12013 **Assimilation and biological turnover of cesium-134, iodine-131, and chromium-51 in brown crickets, Acheta domesticus (L.).** Van Hook, R.I. Jr.; Crossley, D.A. Jr. (Oak Ridge National Lab., TN). *Health Physics;* **16**: 463-467(1969).

Understanding of radionuclide accumulation by insects requires careful assessment of assimilation and turnover rates. In separate experiments, three radionuclides (^{134}Cs, ^{131}I or ^{51}Cr) were fed to adult brown crickets for a 24-hr period. The insects were then transferred to nonradioactive food and their whole-body retention measured at 1-hr intervals. The retention of each radionuclide can be described by a sum of two exponential functions, a shorter one related to loss of unassimilated radionuclide from the gut and a

longer one describing excretion of assimilated radionuclide from tissues. The shorter components had similar rates (half-time = about 4 hr) for all three radionuclides, indicating that they were a measure of gut clearance time. Chromium had the lowest assimilation (6%) and cesium the highest (65%). Assimilated ^{134}Cs and ^{51}Cr were eliminated at moderate rates (biological half-lives of 62 and 83 hr, respectively) but assimilated ^{131}I was stored rather than excreted. 18 references, 2 figures, 1 table.

12014 **Distribution of sulfur in the wheat grain as shown by radioautographs.** Seidman, G.; Frazier, J.C. (Kansas State Univ., Manhattan). *Plant and Soil;* **19**: No. 1, 151-152(Aug 1963).

Radioautographs of sections of wheat grains in the dough stage 2 to 5 weeks after treatment with S^{35} indicated appreciable quantities of S^{35} concentrated in the embryo and particularly in the aleurone layer of the bran. An even distribution of low concentration occurred throughout the endosperm. The pericarp was nearly free of radioactivity. This report gives added data to show that the highest concentration of radioactive sulfur in the wheat kernel was deposited in the germ, with bran and endosperm following in order. Radioautographs obtained of longitudinal sections of wheat grains showed the gross distribution of S^{35} in the grain, including a striking localization of radioactivity on the inner surface of the crease. Wheat plants used in this study were grown hydroponically in the greenhouse. The variety was Pusa 52 x Federation, a short-season hard spring wheat. Twenty millicuries of S^{35} in the form of sulfate in weak HCl obtained from the Oak Ridge National Laboratory was prepared for aliquoting by diluting to 5.2 ml with distilled water. One tenth of a milliliter (385 microcuries) was added to each jar which supported three plants. Wheat grains were prepared for sectioning on a freezing microtome by embedding in gelatin. The embedded grains were sliced into longitudinal sections about 500 microns thick. The gelatin was peeled off, then the sections were held in direct contact with the photographic emulsion of Kodak No-screen X-ray film in a light-tight box for 96 hours. The film was developed using X-ray developer and fixer. 2 references, 1 figure.

12015 **Physicochemical rationale for the biological activity of mercury and its compounds.** Hughes, W.L. (Brookhaven National Lab., Upton, NY). *Annals of the New York Academy of Sciences;* **65**: 454-460(1957).

An equation is presented which describes the affinity of methylmercury for biological substances. Relative affinities for various biological substances may then be obtained by comparing the equilibrium constants for the reaction. The distribution of methylmercury in the body is discussed, and the preferential accumulation of mercury salts in kidney, liver, and spleen is discussed. The data available on the distribution of mercury in human tissues indicate that pathological effects are the result of real concentrations of mercury in the affected organs. In the case of the brain, which has been considered extremely sensitive to mercury, mental impairment has been found at levels of greater than 1 ppm. 17 references, 2 tables.

5604 Other Environmental Pollutant Effects

12016 **(DOE/RA/50219—T7) Effects of 60 Hz electric fields on operant and social stress behavior of nonhuman primates. Quarterly technical progress report No. 20, September 28-December 20, 1985.** Rogers, W.R. (Southwest Research Inst., San Antonio, TX (USA)). 3 Jan 1986. Contract AC02-80RA50219. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005067.

This research program will evaluate the aversive character of exposure to 60 Hz electric fields by determining the threshold intensity which produces avoidance or escape responses, will estimate the threshold intensity for detection of 60 Hz electric fields, will assess effects of chronic exposure to 60 Hz electric fields on the performance of two operant conditioning tasks, fixed ratio and differential reinforcement of low rate responding, will investigate, using the systematic quantitative observational sampling methods of primatology, the possible stress-inducing effects of chronic exposure to 60 Hz electric fields on the behavior of baboons living in small social groups. In all experiments, the electric fields will be described, characterized, and controlled to account for recognized artifacts associated with high intensity 60 Hz electric fields and the health of all subjects will be described using the methods of primate veterinary medicine.

12017 **(EPRI-EA—4318-Vol.1) Biological studies of swine exposed to 60-Hz electric fields. Volume 1. Overview and summary. Final report.** (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 127p. NTIS, PC A07/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE86005358.

Over a three-year period, three generations of female miniature swine and their offspring were exposed to a 30-kV/m, 60-Hz electric field. Such a field approximates the 12-kV/m field that a human would experience under a 765-kV line. After swine exposures varying from 6 to 36 months, project personnel analyzed a wide range of biological parameters including growth, blood cell and serum biochemistry, blood immunoglobulin levels, behavior, peripheral nerve function, cell-mediated immunity, cytogenetics, and reproduction and development. There were no significant differences in health effects between the exposed and sham-exposed swine, except in the area of fetal development. The first breeding produced no significant difference between exposed and control offspring. When those offspring were bred after 18 months of exposure, the fetuses of exposed sows had an increased incidence of morphological malformations and lower body weight than fetuses from control sows. The live-born had lower body weights and increased birth defects. Several factors suggest that electric fields per se may not have caused these reproductive changes. For example, similar types of malformations occurred in control pigs. Also, in second-generation sows, the incidence of fetal malformations was similar for both exposed and control groups. It is possible that other factors such as housing, inbreeding, disease, or treatment of disease may have produced the observed effects. 64 refs., 13 figs., 25 tabs.

12018 **(EPRI-EA—4318-Vol.2) Biological studies of swine exposed to 60-Hz electric fields. Volume 2: Behavior. Final report.** (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 50p. NTIS, PC A03/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE86005359.

The behavioral responses in three generations of miniature swine chronically exposed to a 30-kV/m, 60-Hz electric field have been assessed in a series of screening experiments. Tests were conducted on mature swine as well as on very young swine and weanlings and included measures of: (1) preference for exposure to or shielding from the electric field; (2) early neuromuscular development; (3) exploratory behavior; (4) simple learning and memory function; and (5) short-term memory. Repeated evaluations of behavioral parameters show few statistically significant effects. In the parental (F_0) generation, exposed sows showed a preference to remain out of the field, particularly during the dark period. Adult first-generation (F_1) sows, however, failed to demonstrate such a preference to stay out of the field. In other behavioral assessments, the singular significant effect in F_1 swine was the increased number of vocalizations in both male and female swine during the exploratory behavior test. This result, also inconsistent across generations, was not repeated in the second-generation (F_2) exploratory tests, where exposed female swine made significantly fewer vocalizations than their sham-exposed counterparts. The study provides no other evidence of an overall behavioral effect in swine of prenatal exposure to electric fields. 13 refs., 5 figs., 11 tabs.

12019 **(EPRI-EA—4318-Vol.3) Biological studies of swine exposed to 60-Hz electric fields. Volume 3. Exposure system and dosimetry. Final report.** (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 87p. NTIS, PC A05/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE86005360.

A facility for the exposure of miniature swine to vertical 60-Hz, 30-kV/m electrical fields has been designed and constructed. The electric-field uniformity over the area of a swine stall was +-

2.5% at ground level and +-8% at the maximum height of a swine. The current between a drinking swine and its water nozzle was less than 20 mA. No levels of audible noise, hum, vibration, or ozone attributable to the high-voltage system have been detected. The total electric-field harmonic distortion was 0.5%. The effects of electric-field shielding between pigs housed close to each other was investigated. Using a detailed estimate of average body weight of the swine, it has been estimated that the average effective field strength in the swine barn was about 25 kV/m. In addition, included in this report is research outlining the relationships that enable data obtained with swine to be approximately scaled to human-exposure conditions. In terms of the peak electric field strength acting on the surface of the body, exposure of pigs to 25 kV/m is equivalent to human exposure at 9.3 kV/m. If average surface electric field strength is used, this equivalency is 25 kV/m for pigs and 13 kV/m for humans. If average axial current density in the torso is used as a scaling parameter, the data showed that exposure of pigs to 25 kV/m is equivalent to human exposure at about 2 kV/m. Clearly, the different body shapes of humans and animals must be taken into account when extrapolating electric-field biological data across species. 32 refs., 21 figs., 19 tabs.

12020 **(EPRI-EA—4318-Vol.4) Biological studies of swine exposed to 60-Hz electric fields. Volume 4: growth, reproduction, and development. Final report.** (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 74p. NTIS, PC A04/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE86005361.

Swine were exposed to uniform, vertical, 60-Hz, 30-kV/m electric fields for 20 hours/day, 7 days/week. The parental generation (F_0 gilts) was bred after 4 months on study; some were killed for teratologic study at 100 days of gestation (dg), and the others produced a first-generation (F_1) of offspring. The pooled incidence of terata in these litters was similar in the exposed and sham-exposed groups. The F_0 females, which produced the F_1 generation, were rebred after 18 months of exposure and were killed at 100 dg: malformation incidence in exposed litters (75%) was significantly greater than in sham-exposed litters (29%). Types of malformations were not dissimilar between the two groups. The F_1 gilts were bred at 18 months of age; there were indications of impaired copulatory behavior and decreased fertility in the exposed animals. Defective offspring were found in significantly more of the exposed litters (71%) than in sham-exposed litters (33%). The F_1 sows were bred again 10 months later, and teratologic evaluations were performed on their second litters at 100 dg. The percentage of litters with malformed fetuses was essentially identical in the exposed and sham-exposed groups (70 and 73%, respectively). The change in malformation incidences between generations and between the first and second breedings makes it difficult to unequivocally conclude that chronic exposure to a strong electric field caused developmental effects in swine, although it appears there may be an association. It is also possible that other factors, such as housing, inbreeding, disease or its treatment may have contributed to the results. 22 refs., 9 figs., 28 tabs.

12021 **(EPRI-EA—4318-Vol.5) Biological studies of swine exposed to 60-Hz electric fields. Volume 5. Hematology and serum chemistry. Final report.** (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 127p. NTIS, PC A07/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE86005362.

The hematologic and serum chemistry responses in three generations of miniature swine chronically exposed to a 30-kV/m, 60-Hz electric field have been assessed in a series of screening experiments. Based on comprehensive analyses and sequential statistical evaluation of the data, there are no significant differences in any hematologic parameters in either the F_0 or F_1 generations when the exposed and sham-exposed groups are compared. In F_2 swine, at 42 days of age reticulocyte values were significantly higher in both sexes exposed to the electric field than in the control group. In addition, the exposed males at 42 days had significantly lower values for erythrocytes, hemoglobin and volume of packed red cells than the control males. Other values were comparable between exposed and control groups. Serum chemistry evaluations between exposed and control groups also showed no consistent statistical differences. A few parameters did show occasional differences between groups in the F_1 and F_2 generations, including: higher levels of urea nitrogen, triglyceride and alkaline phosphatase in exposed F_1 piglets; significantly lower serum protein levels in exposed F_2 males; and fewer serum globulins in both sexes of the F_2 generation. In summary, when hematologic and serum chemistry parameters were compared in exposed and sham-exposed groups of swine, some sporadic effects were evident. These effects, however, failed to replicate consistently at subsequent sampling periods or across generations and were not present as statistical trends when appropriate multivariate analyses were performed. 28 refs., 89 figs., 6 tabs.

12022 **(EPRI-EA—4318-Vol.6) Biological studies of swine exposed to 60-Hz electric fields. Volume 6. Immunology. Final report.** (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 61p. NTIS, PC A04/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE86005363.

Immunological response in three generations of miniature swine chronically exposed to a 30-kV/m, 60-Hz electric field have been assessed in a series of screening experiments. The study was designed to investigate functional aspects of the humoral and cellular components of the mammalian immune system. Circulating levels of immunoglobulins were measured in parental-generation (F_0) sows (0 to 22 months of exposure), first-generation fetuses (F_1) at 100 days of gestation, F_1 females (0 to 32 months of exposure) and second-generation (F_2) weanlings at 1.5 and 6 months of age. No consistent, statistically significant changes in the levels of serum immunoglobins were observed when exposed groups were compared with sham-exposed controls, either within or across generations. An examination of cellular immunity included measurements of the mitogen response of peripheral-blood lymphocytes (PBL), spleen cells and lymph-node cells of F_0 sows sacrificed after 100 days of pregnancy, and PBL, spleen cells and thymocytes of F_1 fetuses at 100 days of gestation. Mitogen response studies of PBL, spleen cells, thymocytes and lymph-node cells of 42-day-old F_1 male weanlings and F_2 male and female swine were also conducted. In the statistical comparisons of mitogen-response data obtained for F_0, F_1, and F_2 swine, no consistent differences were observed between exposed and matched sham-exposed control groups. These observations indicate that the distribution of cells in the various tissues studied and the responses observed were not altered as a result of exposure to the fields. 22 refs., 27 figs., 5 tabs.

12023 **(EPRI-EA—4318-Vol.7) Biological studies of swine exposed to 60-Hz electric fields. Volume 7. Neurology. Final report.** (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 107p. NTIS, PC A06/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE86005364.

Neurophysiological responses in three generations of miniature swine chronically exposed to a 30-kV/m, 60-Hz electric field have been assessed in a series of screening experiments. Results are presented from experiments on peripheral nerve function in parental (F_0) female swine at 100 days of gestation, and from experiments on synaptic transmission in first- and second-generation (F_1 and F_2) progeny at 6 weeks of age, all following chronic exposure to a 60-Hz electric field. In the several measures of peripheral nerve function examined, only two showed consistent differences between exposed and sham-exposed animals: C-fiber (but not B-fiber) conduction velocity was decreased in nerve preparations from exposed swine, and recovery, as measured by the increase in amplitude of the compound action potential, was consistently, although not statistically, less in B- and C-fibers from exposed animals when compared to values for the sham-exposed controls. Although changes (increases or decreases) in various parameters of synaptic transmission were observed between exposed and sham-exposed groups, the differences were not consistent across experiments or generations. Only one measure of synaptic function showed a consistent difference throughout the studies: the conduction velocities of B and C components of the postsynaptic compound action potential were increased following electric-field exposure (statistically significant only in B-fibers of the F_2 generations). 7 refs., 60 figs., 17 tabs.

12024 **(PB—85-243467/XAB) Biological effects of electric fields.** Phillips, R.D. (Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.). Aug 1985. 31p. (EPA/600—D-85/174). NTIS, PC A03/MF A01.

The paper represents a cursory overview of research concerned with the biological consequences of exposure to extremely-low-frequency radiation. It summarizes epidemiological and clinical studies conducted to date and a somewhat more extensive examination of results of studies using experimental animals. In an attempt to help the reader evaluate and interpret those results, a discussion of current concepts on possible mechanisms and future directions of research are presented.

12025 **(PNL-SA—12608) Viabilities and mutation frequencies of CHO-K1 cells following exposure to 60-Hz electric fields.** Frazier, M.E.; Samuel, J.E.; Kaune, W.T. (Pacific Northwest Labs., Richland, WA (USA)). Oct 1985. Contract AC06-76RL01830. 30p. (CONF-8510225—3). NTIS, PC A03/MF A01; GPO Dep. File Number DE86004864.

From Hanford life sciences symposium; Richland, WA, USA (21 Oct 1985).

Chinese hamster ovary (CHO) cells were exposed to 60-Hz ac electromagnetic fields at strengths from 0.15 V/m to 10.9 V/m, using an exposure system which magnetically induces an electric field in the culture medium without the use of electrodes. Electric-field exposure with this system had no detectable cytotoxic or mutagenic effects. Mutation frequencies were not significantly increased at any of the electric-field strengths or exposure durations. However, cell viability, as measured by plating efficiency (ability of a cell to produce a colony), was significantly reduced. The threshold of detectability for this effect was a 24-h exposure at 0.7 V/m. As a result of these findings, and because of limitations of the exposure system, we designed and tested another exposure system which allowed exposure at higher field strengths. This system employs carbon electrodes directly coupled to the culture medium. To assure that electrode effects did not perturb the experiment, agar bridges were interposed between the electrodes and the cell suspension. The plating efficiency of cells exposured to 3.5 V/m in the agar-bridge graphite-electrode exposure system was not significantly different from those of control cultures. Therefore, the decreased cloning efficiency observed with the magnetically induced electric field may be either artifactual or a function of the system itself (i.e., the greater magnetic component relative to that of the agar-bridge exposure chamber). 22 refs., 9 figs., 2 tabs.

57 HEALTH AND SAFETY

12026 **(PB—85-242667/XAB) Development of statistical distributions or ranges of standard factors used in exposure assessments. Final report.** Anderson, E.; Browne, N.; Duletsky, S.; Ramig, J.; Warn, T. (GCA Corp., Chapel Hill, NC (USA). GCA Technology Div.). Aug 1985. 183p. NTIS, PC A09/MF A01.

The document is intended to support EPA's Exposure Assessment Guidelines by providing data and information on standard factors that are used to calculate human exposure to toxic substances. Statistical distributions or ranges of values were developed for body weight, skin surface area, and ventilation rates. Percentile distributions of body weight were computed from the Second National Health and Nutrition Examination Survey (NHANES II) data base using a computer program that performs variance estimation of multistage sample data using the Jack-knife Repeated Replicate approach. Distributions of skin surface areas were similarly calculated from NHANES height and weight data by applying regression equations that were either located in the literature or were developed by multi-variate analysis of available measurements. Insufficient data precluded the development of distributions of ventilation rates. Minimum, maximum, and mean values of minute ventilation at three activity levels were calculated from available measurements. Activity pattern information is presented to permit the calculation of time-weighted average ventilation rates.

12027 **(PB—85-243566/XAB) Biomechanical and work physiology study in underground mining, excluding low coal. Open file report, 25 January 1980-22 July 1984.** Ayoub, M.M.; Selan, J.L.; Burford, C.L.; Intaranont, K.; Rao, H.P.R. (Texas Tech Univ., Lubbock (USA)). Jul 1984. 212p. NTIS, PC A10/MF A01.

The objective of this project was to conduct a biomechanical and work physiology study of underground mines (excluding low coal) to generate data to be utilized in equipment and job design. Anthropometric, strength, physical work capacity, and nutritional intake measurements were collected on miners. Energy expenditure and postural data were collected on mining tasks to identify those tasks that were demanding. Male underground miners were not significantly different than comparison populations in terms of anthropometric characteristics, but they were significantly stronger. Females were heavier and larger in terms of circumferential measurements than comparison populations and were stronger. Both males and females were generally rated low in terms of aerobic capacity, and their nutritional intake did not appear to be adequate in terms of daily energy expenditure or recommended dietary allowances. Daily energy expenditures for mining jobs appeared to be reasonable in terms of percentage aerobic capacity, but this was due largely to travel and down time. Several mining tasks imposed stressful postures on miners. Recommendations based on the data collected are made.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 10998, 11040, 11044, 11045, 11073

12028 **(BNL—37356) Guidebook for the assembly and use of diverse ground water data.** Kaplan, E.; Naidu, J.; Hauptmann, M.; Meinhold, A. (Brookhaven National Lab., Upton, NY (USA)). Apr 1985. Contract AC02-76CH00016. 219p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86005270.

In any area or region where the quality of ground water is of concern, ground water data are likely to exist in many places and in many forms, and making such data available to the analyst or decision maker is a difficult task. The analysis and assessment of ground water data are also difficult. Because of the complexity of ground water systems, and the variability of the spatial and temporal characteristics of the data as well as of the collection and laboratory procedures, standard analytical techniques are not always valid or useful. In this guidebook, we have presented a methodology for identifying and integrating available data in a useful form, and for analyzing these data using statistical, modeling, and graphical techniques. The guidebook is aimed primarily at the local agency, with minimum manpower and equipment available, which is responsible for making evaluations based on a large but possibly imperfect collection of data. 17 refs.

12029 **(HW—67729) Geology underlying 200-area tank farms.** Brown, D.J. (General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation). 22 Dec 1960. Contract AC06-76RL01830. 18p. NTIS, PC A02. File Number DE86005008.

Geologic cross sections were prepared showing the types of earth materials situated beneath the eleven tank farms located within the separation areas. In general the sedimentary deposits beneath the 200-West Area tank farm contain finer grained and better sorted material than do these deposits beneath the 200-East Area. The depth to the regional water table is 30 to 90 feet less beneath the 200-West Area than beneath the 200-East Area because of the proximity of these tank farms to the 200-West groundwater mound. 3 refs., 12 figs.

12030 **(RHO-BW-ST—71-P) HEADCO: a program for converting observed water levels and pressure measurements to formation pressure and standard hydraulic head.** Spane, F.A. Jr.; Mercer, R.B. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Oct 1985. Contract AC06-77RL01030. 117p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86005143.

Static water-level and fluid pressure measurements are commonly converted in hydrologic studies to formation pressure and hydraulic head, which are used to determine groundwater flow characteristics of aquifer systems. While the direct use of field measurements is usually adequate for determining formation pressure and hydraulic head for shallow flow systems (i.e., <1000 ft), corrections and conversion parameters must be used to properly account for fluid-column density effects, which commonly occur with deep systems. This report presents a program, HEADCO, for converting static water-level and pressure measurements to formation pressure and standard hydraulic head. The HEADCO program corrects field measurements for the effects of fluid-density variation and selected external stresses. Factors that affect density of the fluid column, in which field measurements are made, include temperature, pressure, salinity, suspended solids, and multiphase conditions. External stresses examined in HEADCO include barometric and earth tide fluctuations, and gravitational acceleration variation. A program description and procedures for converting field measurements obtained using field test arrangements commonly employed in the Basalt Waste Isolation Project field program are provided in this report. The report includes user instructions and an illustrative test example. Results of a field example comparison are also provided. This comparison examines observed and HEADCO-calculated pressures for 30 pressure probes recently calibrated in a laboratory and tested under field conditions at borehole DC-8. The test case and field example comparisons indicate that HEADCO provides accurate estimates of formation pressure and standard hydraulic head that are well within the accuracy range of downhole pressure-measuring instrumentation. 44 refs., 14 figs., 8 tabs.

12031 **(USGS-OFR—85-620) Topographic maps of Yucca Mountain area, Nye County, Nevada.** Wu, S.S.C. (comp.). (Geological Survey, Denver, CO (USA)). 1985. Contract AI08-78ET44802. 55p. NTIS, PC A04/MF A01. File Number DE86900530.

This report consists of 6 topographic maps of Yucca Mountain area, Nye County, Nevada. These maps are preliminary and have not been reviewed for conformity with US Geological Survey editorial standards and stratigraphic nomenclature. (AT)

5802 Geophysics

REFER ALSO TO CITATION(S) 11854

12032 **(UCRL—53542) Seismicity rates for East Bay faults.** Scheimer, J.F.; Mills, J.M. (Lawrence Livermore National Lab., CA (USA)). 29 Mar 1984. Contract W-7405-ENG-48. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005305.

Using both maximum-likelihood and least-square techniques, we have calculated both a- and b-values for nine source zones in the Eastbay region. The source zones include the Hayward, Calaveras, Grenville, Las Positas, and Verona Fault zones, as well as diffuse source zones in the Diablo Range. We have made use of a number of earthquake catalogs, including those of the US Geological Survey (USGS), the California Division of Mines and Geology (CDMG), and the Seismographic Station at the University of California, Berkeley (UCB). Taken together, these catalogs provide information for the time period 1900 to the present, although they vary in completeness and time coverage. The b-values calculated for the Hayward and Calaveras Faults using the USGS catalog (which begins in 1969) are 0.90 and 0.95 which are consistent with those derived by other researchers. The b-values calculated for the same zones using the CDMG catalog, which includes data recorded since the beginning of the century, are 0.95 and 0.78, respectively. We have used a number of permutations of technique and catalog to calculate a- and b-values for all of the zones. In addition the variance of the b-values calculated using the maximum-likelihood estimator have been calculated; and the statistical significances of variations in b-values between different populations have been estimated. 12 refs., 12 figs., 2 tabs.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 10751, 10767, 10770, 10773, 10774, 11009, 11038

12033 **(SAND—84-1101) Uniaxial and triaxial compression test series on Topopah Spring Tuff from USW G-4, Yucca Mountain, Nevada.** Nimick, F.B.; Price, R.H.; Van Buskirk, R.G.; Goodell, J.R. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1985. Contract AC04-76DP00789. 113p. NTIS, PC A06/MF A01; GPO Dep. File Number DE86005333.

Fifty-seven uniaxial and triaxial compression experiments were performed on cylindrical samples taken from the Topopah Spring Member of the Paintbrush Tuff from drillhole USW G-4 at Yucca Mountain in southern Nevada. All of the samples were nominally 25.4 mm in diameter, 50.8 mm in length, and 100% water saturated. All samples were deformed in compression at room temperature under confining pressures ranging from atmospheric to 10 MPa and nominal strain rates from 10^{-7} to 10^{-3} s^{-1}.

5804 Geochemistry

REFER ALSO TO CITATION(S) 11065

5805 Oceanography

REFER ALSO TO CITATION(S) 11039, 11907, 11913

12034 **(DOE/EV/00901—T5) Coordination: Southeast continental shelf studies. Progress report, 1 June 1984-31 December 1985.** Menzel, D.W.; Blanton, J.O. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 3 Jan 1986. Contract AS09-76EV00901. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005139.

This overview and report of progress on the South Atlantic Bight Program includes discussions of: (1) dynamics of the coastal zone; (2) circulation studies; (3) biological transformations in the coastal boundary zone; (4) sediment geochemistry; and (5) continental shelf processes. (ACR)

12035 **(SAND—82-2947) NEPTUNE: a finite element code for creeping flow of saturated cohesive porous media (Version 1.0).** Dawson, P.R.; Chavez, P.F.; Martinez, M.J. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1985. Contract AC04-76DP00789. 139p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86005336.

The theoretical background, numerical formulation, and user instructions are provided for the finite-element computer code, NEPTUNE. Sample problems demonstrating its application analyzing the deformations of saturated porous media are presented.

64 PHYSICS I

REFER ALSO TO CITATION(S) 12268

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 11842, 12055, 12172, 12173, 12290, 12360, 12419

12036 **(BNL—37316) Hypernuclear gamma rays.** May, M. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 11p. (CONF-850921—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005050.

From 5. international conference on hypernuclear and kaon physics; Upton, NY, USA (9 Sep 1985).

The observation of hypernuclear γ rays pprovides a method of determining the spin dependence of the Λ-nucleon interaction with a sensitivity not approachable by other means in the forseeable future. The transitions of primary interest are those between states that differ only in the orientation of the spin of the Λ particle with respect to the angular momentum of the nuclear core. The effective Λ-nucleon interaction can be specified by a small number of γ-ray measurements. A program of experiments directed at this goal is in progress at Brookhaven National Laboratory. This paper reviews the status of the subject with emphasis on the recent experiment to measure ground state doublet splittings using germanium γ-ray detectors.

12037 **(CBPF-NF—003/84) Pulsar precession: a nod is not as good as a wink.** Heintzmann, H.; Novello, M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700362.

The problem of pulsar wobble is reassessed and the most favourable cases are selected. Chances for an actual detection appear to be dim.

12038 **(CBPF-NF—005/84) Closed homogeneous cosmological model with short range magnetic field.** Costa, J.L.C.; Wolk, I.; Fonseca Teixeira, A.F. da. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 9p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700363.

It is shown that all symmetries of Einstein universe are preserved upon insertion of a uniform, Clifford-parallel massive magnetic field.

12039 **(CNRS-CPT—84-PE-1703) Universe symmetries.** Souriau, J.M. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). 1984. 37p. (In French). (CONF-8402156—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE86750351.

From Meeting of the Science Academy; Paris, France (6 Feb 1984).

The sky uniformity can be noticed in studying the repartition of objects far enough. The sky isotropy description uses space rotations. The group theory elements will allow to give a meaning at the same time precise and general to the word a "symmetry". Universe models are reviewed, which must have both of the following qualities: - conformity with the physic known laws; - rigorous symmetry following one of the permitted groups. Each of the models foresees that universe evolution obeys an evolution equation. Expansion and big-bang theory are recalled. Is universe an open or closed space. Universe is also electrically neutral. That leads to a work hypothesis: the existing matter is not given data of universe but it appeared by evolution from nothing. Problem of matter and antimatter is then raised up together with its place in universe.

12040 **(IFUSP-P—480) Formation of structures in the very early universe.** Bertolami Neto, O.; Marques, G.C.; Ventura, I. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700364.

An alternative picture of cosmological phase transition is sketched and its implications to the formation of structures in the very early universe is studied. It is shown that the condensation of walls at high temperatures leads to fluctuations which are in accordance to all necessary conditions to the formation of structures in the universe. Furthermore, the number of aglutination centers is roughly equal to the numbers of great structures observed in the universe today.

12041 **(IFUSP-P—502) New contributions to the cosmological constant.** Jasinschi, R.S.; Smith, A.W. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700365.

It is shown that the quantized gravitino sector of N=1, D=11 supergravity leads to new contributions to the D=4 dimensional cosmological constant, in addition to the one coming from the field strength of the three index totally anti-symmetric tensor field. These new contributions arise from the vacuum expectation values of the different auxiliary fields introduced in order to eliminate the quartic gravitino interaction terms.

12042 **(LA-UR—85-4448) 2-D Eulerian hydrodynamics with fluid interfaces, self-gravity and rotation.** Norman, M.L.; Winkler, K.H.A. (Los Alamos National Lab., NM (USA); Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). 1982. Contract W-7405-ENG-36. 36p. (CONF-820836—3). NTIS, PC A03/MF A01; GPO Dep. File Number DE86004749.

From NATO advanced study institute on radiation hydrodynamics; Munich, F.R. Germany (2 Aug 1982).

The purpose of this paper is to describe in detail the numerical approach we have developed over the past five years for solving 2-dimensional gas-dynamical problems in astrophysics involving inviscid compressible flow, self-gravitation, rotation, and fluid instabilities of the Rayleigh-Taylor and Kelvin-Helmholtz types. The computer code to be described has been applied most recently to modeling jets in radio galaxies (Norman et al. 1981, 1982) and is an outgrowth of a code developed for studying rotating protostellar collapse (Norman, Wilson and Barton 1980; Norman 1980). This basic methodology draws heavily on the techniques and experience of James R. Wilson and James M. LeBlanc of the Lawrence Livermore National Laboratory, and thus the code is designed to be a general purpose 2-D Eulerian hydrocode, and is characterized by a high degree of simplicity, robustness, modularity and speed. Particular emphases of this article are: (1) the recent improvements to the code's accuracy through the use of vanLeer's (1977) monotonic advection algorithm, (2) a discussion of the importance of what we term consistent advection, and (3) a description of a numerical technique for modeling dynamic fluid interfaces in multidimensional Eulerian calculations developed by LeBlanc. 23 refs., 14 figs.

12043 **(UFPB-DF—14/84) Conformal group actions and Segal's cosmology.** Werth, J.-E. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica). 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700366.

A mathematical description of Segal's cosmological model in the framework of conformal group actions is presented. The relation between conformal and causal group actions on time-orientable Lorentzian manifolds is analysed and several examples are discussed. A criterion for the conformality of a map between Lorentzian manifolds is given. The results are applied to Segal's 'conformal compactification' of Minkowski space. Furthermore, the 'unitary formulation' of Segal's cosmology is regarded.

12044 **Mechanism for baryogenesis in supersymmetric inflationary cosmologies.** Mahajan, S. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *D: Particles and Fields;* **33**: No. 2, 338-345(15 Jan 1986). Contract AC03-76SF00098.

We present another mechanism to generate the baryon asymmetry of the Universe within supersymmetric inflationary cosmologies. The gravitational coupling of the inflaton to the heavy fields in the theory is used to generate the baryon excess. We find that, in models with an inflaton field and some heavy fields, there is a generation of baryon number due to the transfer of energy from the inflaton to the heavy sector. We study this general mechanism for two simple models: one in which the inflaton does not break supersymmetry and one for which it does. We find that we can get the observed value of the baryon to entropy ratio in these models. The thermal constraint (stabilization of the inflaton in the plateau region at high temperatures) is violated in both these models. We discuss the possibility of the introduction of direct couplings to satisfy this constraint.

12045 **Thermodynamic stability of cosmological models.** Horwitz, G.; Weil, D. (Racah Institute of Physics, The Hebrew University, Jerusalem 91000, Israel). *Physical Review* [*Section*] *D: Particles and Fields;* **33**: No. 2, 567-569(15 Jan 1986). Contract AC02-83ER40118.

The thermodynamics of homogeneous isotropic universes ($k>0$, $\Lambda>0$) with conformal scalar radiation is analyzed, in analogy with the thermodynamics of black holes in a cavity, as the mutual equilibrium between two subsystems (quantum thermal bosons and semiclassical conformal metric modes) fluctuating under an energy constraint corresponding to the analytic continuation of one of Einstein's equations. The global stability of the cosmological thermal state previously deduced from a statistical computation is confirmed, while the (de Sitter) vacuum state turns out to be locally unstable to creation and heating of matter, and can decay, by an irreversible quasistatic process of energy extraction from gravity, to the equilibrium state compatible with an inflationary cosmology.

12046 **String-generated gravity models.** Boulware, D.G.; Deser, S. (Department of Physics, FM-15, University of Washington, Seattle, Washington 98195). *Physical Review Letters;* **55**: No. 24, 2656-2660(9 Dec 1985). Contract AC06-81ER40048.

Expansion of supersymmetric string theory suggests that the leading quadratic curvature correction to the Einstein action is the Gauss-Bonnet invariant. We show that this model has both flat and anti—de Sitter space as solutions, but that the cosmological branch is unstable, because the graviton becomes a ghost there: The theory solves its own cosmological problem. The general static spherically symmetric solution is exhibited; it is asymptotically Schwarzschild. The sign of the Gauss-Bonnet coefficient determines whether there is a normal event horizon (for the string-generated sign) or a naked singularity. We discuss the effects of higher-curvature corrections and of an explicit cosmological term on stability.

12047 **Galactic antiprotons from photinos.** Stecker, F.W.; Rudaz, S.; Walsh, T.F. (NASA Goddard Space Flight Center, Greenbelt, Maryland 20771). *Physical Review Letters;* **55**: No. 23, 2622-2625(2 Dec 1985). Contract AC02-83ER40105.

Stable photinos, the photino being the supersymmetry partner of the photon, can explain both the "missing mass' in galactic halos and the cosmic-ray antiproton spectrum up to the highest energies observed so far. This requires a photino mass around 15 GeV; significantly higher masses are cosmologically disfavored. As a consequence, we find that the observed cosmic-ray antiproton-to-proton ratio is predicted to decrease abruptly just above the measured energy range, at E = m/sub chi/. If observed, this striking effect would strongly support the hypothesis that photinos make up the missing matter in our galaxy and also lead to a measurement of the photino mass from cosmic-ray data.

12048 **Expanding vortex site for the r-process in rotating stellar collapse.** Symbalisty, E.M.D.; Schramm, D.N.; Wilson, J.R. (Los Alamos National Lab., NM). *Astrophysical Journal;* **291**: L11-L14(Apr 1985).

The astrophysical site of r-process nucleosynthesis is investigated theoretically using two-dimensional expanding-vortex stellar-collapse simulations based on the Eulerian adaptive-mesh MHD code of Symbalisty (1984). The results are presented graphically, and it is found that the classical r-process can be explained as the result of the collapse of the highly rotating iron core of a 15-solar-mass star, in which the angular velocity along the rotation axis reaches a maximum of 1000 rad/s, corresponding to an angular momentum of 3.4 x 10 to the 48th erg/s for the inner 1.5 solar mass. The ejected jets are shown to yield about 0.0004 solar mass per supernova, sufficient to explain the observed abundances of r-process products. 20 references.

12049 **Astrophysics. Volume 1. Stars.** Bowers, R.L.; Deeming, T. Boston, MA; Jones and Bartlett Publishers, Inc. (1984). 378p.

The text is intended for a senior-level or first-year graduate-level course in astrophysics. Volume 1 covers a wide range of subjects in stellar astrophysics. An overview of stellar structure and evolution is provided, taking into account stars, energy transport and generation in stars, stellar time-scales, static configurations (hydrostatic equilibrium), the virial theorem, relativistic effects, star formation, and stellar evolution. Other subjects discussed are related to properties of matter, aspects of observational astronomy, static stellar structure, radiation and energy transport, atomic properties of matter, nuclear energy soruces, the main sequence, evolution away from the main sequence, deviations from quasi-static evolution, the final stages of stellar evolution, weak interactions in stellar evolution, degenerate stars, supernovae, compact stellar and relativistic objects, and close binary systems. Attention is given to neutron stars, gravitational collapse and black holes, white dwarfs, neutrino energy-loss rates, and solar neutrinos. 78 references.

12050 **Astrophysics. Volume 2. Interstellar matter and galaxies.** Bowers, R.L.; Deeming, T. Boston, MA; Jones and Bartlett Publishers, Inc. (1984). 283p.

The astrophysics of interstellar matter, galaxies, and cosmology is presented in an intermediate-level college textbook. Chapters are devoted to interstellar matter, interstellar dust grains, gaseous nebulae, hydrodynamics, the virial theorem, star formation, supersonic flow and shock waves, diffuse supernova remnants, the expanding universe, galaxies, dynamics of stellar systems, axially symmetric galaxies, spiral structure, and galactic evolution. Diagrams, graphs, photographs, and problems are provided. 48 references.

12051 **Solar breeder to explain constant luminosity and the lack of neutrinos.** Alexander, C.; Perry, A.M.; Levine, L.H.; Libby, L.M. (Oak Ridge National Lab., TN). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 273-276(1983). (CONF-820989—).

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

A breeder supplying energy in the sun runs for billions of years. Instead of solar neutrinos, it produces antineutrinos from fission products and actinide decays. It gives the sun constant luminosity as required by archaen biology. This follows because reactors are negatively thermostatted.

12052 **Non-LTE astrophysics and the origin of high energy cosmic rays.** Colgate, S.A. (Los Alamos National Lab., NM). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 306-312(1983). (CONF-820989—).

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

The most startling aspect of the universe is the departure from the nonuniform, nonthermodynamic equilibrium state. Mass concentrations and high energy electromagnetic quanta and particles are the primary examples. Of these various departures the extremum of nonexplained phenomena is still the acceleration of cosmic rays. The usual explanation involving multiple mechanisms contributing to various regions of the spectrum is suggested as most unlikely. In particular, the suggestion that the acceleration of the very highest energy cosmic rays is by distant active galactic nuclei is shown to be untenable because of photon particle interactions.

6402 Atmospheric Physics

12053 **(AD-A—157832/7/XAB) Effects of whistler-mode and other waves in the magnetosphere. Final report 1981-1984.** Schultz, M.; Vampola, A.L.; Boucher, D.J. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 20 Jun 1985. 108p. (TR—0084(4613)-1). NTIS, PC A06/MF A01.

This report covers progress on three research topics related to the dynamics of natural and artificial radiation belts, with emphasis on the consequences of interactions between geomagnetically trapped electrons and waves that propagate in the magnetospheric plasma. Part I includes a review of the Kennel-Petschek saturation concept and a solution of the model nonlinear differential equation that describes the evolution of charged-particle intensities above, near, and below saturation level. Part II provides an estimate of the limiting energy spectrum of a saturated radiation belt of specified pitch-angle anistropy. Part III provides a review of eigenfunction methods in pitch-angle diffusion theory and a prescription for constructing optimal basis functions for the numerical calculation of eigenvalues and eigenfunctions of the pitch-angle diffusion operator.

12054 **(AD-A—157930/9/XAB) Behavior of ionized plasma in the high latitude topside ionosphere. Memorandum report.** Ganguli, S.G.; Mitchell, H.G.; Palmadesso, P.J. (Naval Research Lab., Washington, DC (USA)). 27 Aug 1985. 40p. (NRL-MR—5623). NTIS, PC A03/MF A01.

We have developed a numerical model to study the steady-state behavior of a fully ionized plasma (H+, O+, and the electrons) encompassing the geomagnetic field lines. The theoretical formulation is based on the 16-moment system of transport equations. The electron gas is collision dominated below 2500 km. Above this altitude electron-temperature anisotropy develops with temperature perpendicular to the field line being higher than that parallel to the field line. The H^+y ion temperature anisotropy shows H^+ temperature parallel to the field line being higher than that perpendicular to the field line. H^+ ion temperature also exhibits adiabatic cooling; as the supersonic ion gas cools down, it expands in a diverging magnetic field. Results are in good agreement with the previous theoretical studies of the polar wind and recent experimental observations. This is the first successful steady state solution to the 16-moment set of transport equations.

12055 **(CNRS-CPT—84-P-1705) Trapping in stochastic mechanics and applications to covers of clouds and radiation belts.** Albeverio, S.; Blanchard, P.; Combe, P.; Rodriguez, R.; Sirugue, M.; Sirugue-Collin, M. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Nov 1984. 10p. (CONF-8410348—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750391.

From 2. workshop on quantum probability applications; Heidelberg, F.R. Germany (1 Oct 1984).

It is possible to assign a stochastic acceleration to conservative stochastic diffusion processes. As a basic assumption, this stochastic acceleration is set equal to the deterministic smooth component of the external force acting on the particle, whereas the influences of the remainder is modelled by a diffusion coefficient. In this paper, we shall try to see whether it can account for the observation in two cases: the cover of clouds of planets and the radiation belts in the planetary magnetic field. We describe the basic properties of Newtonian Diffusion Stochastic Processes and indicate their connection with Schroedinger-like equations. Furthermore we give a heuristic interpretation of the nodal surfaces as impenetrable barriers for Newtonian Stochastic Diffusion Processes. The possible applications to the observed average cloud covering in the planetary atmosphere are presented we discuss the radiation belts (Van Allen Belts) along the previous ideas.

12056 **(FRNC-TH—1771) Characteristics of short distance field of a source radiating at electronic frequencies in a ionospheric plasma. Applications to density and electron temperature measurement by mutual impedance probe.** Debrie, R. (Orleans Univ., 45 (France)). Jun 1983. 315p. (In French). NTIS (US Sales Only), PC A14/MF A01. File Number DE86750326.

Realization of a new type of radio-frequency probe, the mutual-impedance probe (or the quadrupole probe) is developed. Theoretical results obtained with a cold plasma description of the ionized medium with static magnetic field. Transfer impedance between two dipoles in an homogeneous hot and isotope plasma is then calculated. In equatorial ionosphere, measurements made by the H.F. quadrupole probe, in the Veronique rocket, during the Cisaspe experiment, have been interpreted with this hot plasma theory. The influence of a plasma drift with respect to the emitter dipole is analyzed. The influence of a static magnetic field in hot and homogeneous plasma, on the frequency response curve of the mutual impedance is studied. For, in ionospheric plasmas of auroral and polar zones, the earth magnetic field is no more negligible and gives to the plasma dielectric, strongly anisotropic, properties well described by the microscopic theory in hot magnetoplasma. The space time fast evolution of characteristics of plasma encountered in space experiments has been shown up with a new method of measurement the self-oscillating quadrupole probe. The work synthesis is put in a concrete form on the polar satellite Aureol-3 the first results of which are presented. This satellite allows a precise study of ionosphere auroral zones. At last, it is shown that methods developed for electron density and temperature measurements can be transposed in low frequency. In this case, measurements with quadrupole probe allow to get the ion average mass by lower hybrid frequency excitation.

12057 **Electromagnetic instabilities and gyrophase-bunched particles.** Gary, S.P.; Thomsen, M.F.; Fuselier, S.A. (Earth and Space Sciences Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **29**: No. 2, 531-535(Feb 1986).

The linear theory of electromagnetic instabilities at propagation parallel or antiparallel to a uniform magnetic field B/sup(/°)/ sup / is used to calculate the relative phase angle psi/sub j/ between the fluctuating velocity vector of the jth component and the fluctuating magnetic field. A criterion that determines when this phase relationship leads to observable gyrophase bunching during the linear growth phase of an instability is also derived. The theory is applied to bunching of ion components by ion beam instabilities. Among the electromagnetic cool ion beam instabilities, it is found that the right-hand resonant mode is most likely to cause observable gyrophase bunching of an ion beam during linear growth, and that for sufficiently large beam—core relative drift speeds, psi/sub b/ ≅90° at maximum growth for instability propagation parallel to B/sup(/°)/sup /.

12058 **Observations of the right-hand resonant ion beam instability in the distant plasma sheet boundary layer.** Tsurutani, B.T.; Butler, W.; Smith, E.J.; Richardson, I.G.; Cowley, S.W.H.; Thorne, R.M.; Gary, S.P.; Zwickl, R.D.; Akasofu, S. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena). *Journal of Geophysical Research;* **90**: No. A12, 12159-121(1 Dec 1972).

From the ISEE 3 distant tail prime intervals of study (days 24—43 and 169—193, 1983), 66 large amplitude wave events at the plasma sheet boundary layer were identified, analyzed and tabulated. It is found that (1) 83% of the wave events are clearly right-hand polarized in the spacecraft frame (arguments are given as to why they must also be right-hand polarized in the plasma frame), (2) the waves are propagating nearly parallel to the ambient magnetic field (θ/sub k//sub B/$<15°$), (3) they have a significant compressional-to-transverse amplitude ratio (typically 0.2—0.5), of which only part can be ascribed as being due to cross-field propagation, (4) the waves have a maximum amplitude of 6—7 nT peak to peak (presumably caused by a presently unexplained saturation effect), (5) the waves have rest frame frequencies within the range 0.3 to 2.0 Ω^+, and (6) the waves are strongly substorm dependent. Several case studies involving simultaneous energetic (>35 keV) ion measurements have been analyzed and are presented. Highly anistropic, tailward streaming, relatively cold ion beams (1000—100:1 anisotropy ratio) are found to occur in near time coincidence with the waves. The ion beam properties are calculated and are compared with theoretical predictions of right-hand resonant and nonresonant ion beam instabilities. It is demonstrated that for the cases examined, the measured beam and wave parameters are in agreement with the presence of the resonant instability. It is believed that this is the first simultaneous observation of the waves and the unscattered cold ion beam of the right-hand resonant ion beam instability in either space plasma or laboratory measurements.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 11640, 11661, 11670, 11760, 11839, 12273, 12333, 12505, 12505

12059 **(AD-A—157729/5/XAB) Effect of bending potential on calculated product-state distributions for the reaction H + D_2 yields HD + D.** Blais, N.C.; Truhlar, D.G.; Garrett, B.C. (Chemical Dynamics Corp., Columbus, OH (USA)). 1 Mar 1985. 6p. NTIS, PC A02/MF A01.

New experimental methods of probing the internal-state distributions of nascent or near-nascent collision products after laser photolysis have produced exciting new results for vibrational energy transfer probabilities and reaction-product vibrational-rotational distributions in hot-atom and hot-radical collisions. This has generated considerable theoretical activity, including trajectory calculations and approximate quantal scattering calculations. The au-

thors calculated trajectories for H + D_2 yields HD + D using two potential energy surfaces that are identical for collinear geometries but differ for bent geometries. Weakening the bend potential has a negligible effect on the shape of the opacity function and product vibrational distribution but shifts the final rotational distribution upwards.

12060 **(AD-A—158061/2/XAB) Mechanisms of excitation and ionization processes in sputtering. Final report, 1 September 1981-28 February 1985.** Tsong, I.S.T. (Arizona State Univ., Tempe (USA)). 7 Aug 1985. 5p. NTIS, PC A02/MF A01.

The primary objective of our research project is to understand the basic mechanisms governing the inelastic outershell processes, i.e. excitation, ionization, and neutralization, in particle-solid interactions. To this end, the author investigated the particles sputtered when a solid surface is subjected to energetic-ion bombardment. An understanding of the basic mechanisms will allow better interpretation of experimental data obtained by surface analytical techniques which make use of sputtering such as secondary-ion mass spectrometry (SIMS), Auger electron spectrometry (AES), and x-ray photoemission spectrometry (XPS). These techniques are commonly used to study microelectronics problems concerning interfacial properties and diffusion of dopants and impurities.

12061 **(AD-A—158378/0/XAB) Theoretical study of the binding of positrons of gaseous molecules.** Kunz, A.B.; Waber, J.T. (Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering). 1982. 4p. NTIS, PC A02/MF A01.

While a positron will not readily become attached to a neutral symmetrical atom or molecule, it will be bound by negatively charged molecules and molecular fragments. The positron affinities have been calculated for certain isoelectronic series using a Hartee-Fock Hamiltonian with large basis sets of GTO's. The neutral fluorine atom, the OH fragment, and the fluoride and hydroxyl anions are examples of a series investigated.

12062 **(AD-A—158400/2/XAB) Variational-transition-state theory with least-action tunneling calculations for the kinetic isotope effects in the Cl+h_2 reaction: tests of extended-leps, information-theoretic, and diatomics-in-molecules potential energy surfaces.** Tucker, S.C.; Truhlar, D.G.; Garrett, B.C.; Isaacson, A.D. (Chemical Dynamics Corp., Columbus, OH (USA)). 1 May 1985. 20p. NTIS, PC A02/MF A01.

We apply conventional and variational transition state theory with least-action-ground-state and other transmission coefficients to calculate the rate constants and kinetic isotope effects for the reaction Cl + H_2 yields HCl + H. First we consider collinear reactions and compare the calculated results to accurate quantal results for a given potential energy surface. This tests the dynamical methods and shows that they are reliable enough for testing potential energy surfaces. We then make calculations for the three-dimensional reactions employing 11 potential energy surfaces that have been proposed in previous work. Seven of the surfaces are extended LEPS surfaces, as proposed by Persky, Klein, and Stern; Truhlar, Magnuson, and Garrett; and Valencich and co-workers; one is an information-theoretic-bond-order-plus-anti-Morse-bend surface (called AL/AB) proposed by Agmon, Levine, Truhlar, Magnuson, and Garrett; and the final three surfaces are a diatomics-in-molecules-plus-three-center-terms surface proposed by Baer and Last and two diatomics-in-molecules surfaces proposed by Isaacson and Muckerman. Three of the surfaces (the final surface of Persky, Klein, and Stern; the first surface of Truhlar, Magnuson, and Garrett; and the AL/AB surface-all of which have relatively symmetric saddle points) are shown to be more reasonable than the others for predicting the rate constants and the H2/D2 and the HD/DH kinetic isotope effects. The calculations also indicate that the room temperature rate constants are dominated by quantum mechanical tunneling. (Author)

12063 **(AECL—7798) Multi-scattering-Xα method for analysis of the electronic structure of atomic clusters.** Bahrmuz, A.A.; Woo, C.H. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Dec 1984. 317p. NTIS (US Sales Only), PC A14/MF A01. File Number DE86700340.

A computer program, MSXALPHA, has been developed to carry out a quantum-mechanical analysis of the electronic structure of molecules and atomic clusters using the Multi-Scattering-Xα (MSXα) method. The MSXALPHA program is based on a code obtained from the University of Alberta; several improvements and new features were incorporated to increase generality and efficiency. The major ones are: (1) minimization of core memory usage, (2) reduction of execution time, (3) introduction of a dynamic core allocation scheme for a large number of arrays, (4) incorporation of an atomic program to generate numerical orbitals used to construct the initial molecular potential, and (5) inclusion of a routine to evaluate total energy. This report is divided into three parts. The first discusses the theory of the MSXα method. The second gives a detailed description of the program, MSXALPHA. The third discusses the results of calculations carried out for the methane molecule (CH_4) and a four-atom zirconium cluster (Zr_4).

12064 **(CENBG—8425) Production of projectile and target K X-rays by single and multiple electron capture in collisions of Si^{14+} and Si^{13+} ions with argon atoms at 4.5 and 5.5 MeV/amu.** Andriamonje, S.; Chemin, J.F.; Roturier, J. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). 1984. 2p. (CONF-840786—7-Summ.). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750318.

From 9. international conference on atomic physics; Seattle, WA, USA (23 Jul 1984).

Published in summary form only.

12065 **(CERN-EP—85-173) Methods for on-line production of radioactive ion-beams in the $2 < Z < 21$ region.** Ravn, H.L.; Auria, J.M.D.; Borge, M.J.G.; Huang, Y.; Jonsson, O.C.; Nikkinen, L.; Sundell, S. (European Organization for Nuclear Research, Geneva (Switzerland); Simon Fraser Univ., Burnaby, British Columbia (Canada); McGill Univ., Montreal, Quebec (Canada)). 23 Oct 1985. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86900397.

Intense radioactive ion-beams can be formed by transfer of thermalized nuclear reaction products to the ion source of an on-line mass-separator. By bombardment of thick targets with 600 MeV protons secondary ion-beams can be produced with intensities of up to 3% of the primary proton beam. At the ISOLDE mass-separator, ion-beam intensities of the order of 10^{11} atoms/sμA can be obtained for a number of elements in the region $37 < Z < 80$. Development of such beams in the region $2 < Z < 21$ is reviewed. The experimental difficulties like the lack of suitable target materials, the refractory character of the chemical compounds of these elements and low ionization efficiencies are discussed. As a typical example of a beam development, recent results are presented on MgO target from which /sup 17-19/Neon intensities exceeding 10^3 to 10^7 atoms/s gμA were obtained. Extrapolated to Triumf on-line mass-separator conditions, 5 orders of magnitude higher intensities should be obtainable. Finally status and ideas for development of the remaining elements lighter than Scandium are given individually. 25 refs., 5 figs., 3 tabs.

12066 **(CONF-850925—2) Atomic effects of electrons and protons at low energies.** Hippler, R. (Oak Ridge National Lab., TN (USA); Bielefeld Univ. (Germany, F.R.). Fakultaet fuer Physik). 1985. Contract AC05-84OR21400. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005162.

From 3. international symposium on radiation physics; Ferrara, Italy (30 Sep 1985).

Some aspects of electronic and atomic collisions are discussed. Impact ionization by electrons and protons, and electron bremsstrahlung processes are considered in some detail. Emphasis is also given to (uncorrelated and correlated) many-electron process-

es, which are of particular importance in collisions of highly-charged ions with atoms. 84 refs., 15 figs.

12067 (CONF-8509207—8) **First results from the UNISOR collinear laser facility.** Carter, H.K.; Leander, G.A.; Bounds, J.A.; Bingham, C.R. (Oak Ridge Associated Universities, Inc., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Physics). 1985. Contract AC05-76OR00033;AS05-76ER04936. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004785.

From Symposium on recent advances in the study of nuclei off the line of stability; Chicago, IL, USA (8 Sep 1985).

The hyperfine structure and isotope shifts of /sup 189m, 191m, 193m, 193g/Tl have been measured by means of collinear fast-beam/laser spectroscopy. Deformations for the $9/2^-$ isomers are determined to be larger than for the $1/2^+$ ground state and increase with decreasing neutron number. Despite different deformations, rotational properties are nearly identical in /sup 185 to 199/Tl. Microscopic theory ascribes this to a systematic balance between changing deformation and neutron pairing. 8 refs., 4 figs.

12068 (DOE/ER/10371—7) **Negative ion detachment cross sections. Progress report, March 1, 1985-February 28, 1986.** Champion, R.L.; Doverspike, L.D. (College of William and Mary, Williamsburg, VA (USA). Dept. of Physics). Nov 1985. Contract AS05-79ER10371. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004398.

A progress report in given for experiments on electron detachment of alkali negative ions, charge transfer for doubly charges ions, and collisions of negative ions with alkali atoms. (WRF)

12069 (DOE/ER/10565—10, pp 94-98) **Cyclotron control system.** Haenni, D.R.; Hargis, C.; Cowden, T. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

A large fraction of the design work for the K500 cyclotron system is now complete. At the beginning of the project we determined that the new control system should at least provide the following features: (a) a friendly, simple, and sensible operator interface which retains the desirable features and functionality of the present hardwired system for the 88" cyclotron, (b) an enhanced level of parameter monitoring, fault reporting, data logging and safeguards against operating blunders, (c) a means for implementing advanced control strategies by accelerator physicists without requiring modification of the existing system, (d) some general computational services in direct support of cyclotron operation and machine parameter selection, and (e) as much redundancy, potential for expansion, and ease of maintenance as possible. Instead of copying an existing accelerator control system we decided to design a slightly different one. Thus it was possible to integrate into the design ideas gathered from other accelerators (ANL, Fermilab LINAC, IUCF, MSU, and ORNL) and commercially available industrial control systems, experience with the present hardwired cyclotron control system, unique conditions imposed by the general design of the accelerator components, and some amount of innovation. A description of the resulting design and some of the rationale influencing various decisions follows.

12070 (DOE/ER/10565—10, pp 43-45) **Projectile velocity dependence of the alignment of He-like 2P-states of foil excited S projectiles.** Palinkas, J.; Watson, R.L. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

In a recently completed work the alignments of the 2P-states of foil excited He- and H-like Mg ions were determined from the angular distributions of the 2p-1s x-radiation. A beam of 48 MeV Mg^{9+} ions was directed onto a 50 $\mu g/cm^2$ C foil, inclined at +/-45° angles to the beam direction around an axis perpendicular to the plane containing the beam and the spectrometer. The He- and H-like portions of the x-ray spectrum of the Mg projectiles were measured with a plane-crystal Bragg spectrometer rotatable around a pivot axis coincident with the target rotation axis. The angular distribution (and correspondingly the linear polarization) of electric-dipole radiation from aligned ions is characterized by the alignment parameter of the excited state, which is a combination of the ratios of cross sections for populating the different magnetic substates. In the case of a P state, the alignment can be described by either the σ_0/σ_1 cross section ratio or by the alignment parameter $A_2 = (\sigma_1 - \sigma_0)/(2\sigma_1 + \sigma_0)$, where σ_0 (σ_1) is the cross section for populating the P(m=O) (P(absolute value m=1)) state. In the above angular distribution measurement, the alignment was determined by fitting the measured angular distribution with theoretical angular distribution functions using the alignment as a fitting parameter.

12071 (DOE/ER/10565—10, pp 47-48) **Alignment of the 2P-states of He-like Ne recoil ions produced by 1.35 MeV/a.m.u. Ar ion impact.** Palinkas, J.; Pedrazzini, G.J.; Watson, R.L.; Church, D.A.; Kenefick, R.A. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

In a typical ion-atom collision, the cross sections for the population of magnetic substates having different absolute value m/sub j//values are not the same. When this condition exists, the state is said to be aligned, and radiation resulting from its subsequent decay is polarized and anisotropic. Therefore, an intriguing question is whether the observed nonstatistical intensity ratio in Ne recoil ions is just an artifact of the alignment of these states, or is it attributable to some other feature of the collision process? To provide an answer to the question posed above, the polarizations of the X rays emitted in the two transitions of interest were determined by using a crystal spectrometer as a polarimeter. Two spectra taken with parallel and perpendicular crystal orientations at a pressure of 5 torr are compared. (The spectra have been normalized so that the areas of the ^1P peaks are the same). The difference in the intensities of the ^3P peaks at the two crystal orientations clearly indicates that polarization is present and that its effect is readily observable. However, it is obvious that alignment alone cannot account for the nonstatistical $^1P/^3P$ intensity ratio. The $^1P/^3P$ ratio depends on the pressure of the target gas due to the different quenching rates for these two states. Therefore, to investigate the population produced in the primary collision, the value of this ratio in the limit of zero pressure must be determined. The pressure dependence of the $^1P/^3P$ intensity ratio measured in both crystal orientations is shown. The intensity ratio varies linearly with pressure over the range from 20 to 50 torr, however, below 20 torr large deviations from a linear pressure dependence were observed. The difference in the ratio at the two crystal orientations is independent of pressure.

12072 (DOE/ER/10565—10, pp 49-50) **Nonstatistical population of the 1s2p 2^1P_1 and 2^3P_1 states in recoil ions produced by heavy ion impact.** Palinkas, J.; Watson, R.L.; Bandong, B.; Pedrazzini, G.; Can, C. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

It has been shown that the observed nonstatistical $^1P/^3P$ intensity ratio resulting from the radiative decay of He-like Ne 1s2p states produced in 80 MeV Ar ion collisions cannot be attributed to alignment. Contribution to the ^1P population from 1s-2p excitation was found to be a possible cause of the discrepancy, however the magnitude of this contribution appears to be considerably higher than can be justified on theoretical grounds. In the hope of shedding more light on this problem, a series of measurements of the K x-ray spectra of O excited by Ar ion impact on O_2, H_2O and CO_2 target gases was carried out. In an O_2 molecule ionized by heavy ion impact, electron exchange can take place between the two O atoms in the early stages of the molecular explosion and this may affect the $^1P/^3P$ ratio due to the large difference in the lifetimes of the ^1P and ^3P transitions. In an H_2O molecule, however, interatomic transfer effects should be absent. The K x-ray spectra of O in O_2 and H_2O gases at pressures of 15 and 10 torr are shown. Since the lifetime of the 2^3P_1 state of He-like O is an order of magnitude longer than that of Ne, the $^1P/^3P$ ratio of O should show a much steeper pressure dependence than that of Ne. The measurements indicate, however, that the $^1P/^3P$ ratio is nearly constant as a function of pressure in the range from 10 torr to 50 torr. The extrapolated zero pressure limit of the $^1P/^3P$ ratio changes from 4.4 to 3.4 in going from O_2 to H_2O, and hence interatomic electron transfer

as a reason for the nonstatistical ratio is again ruled out. Spectra of O_2 and H_2O were taken at several pressures with the reflection plane of the crystal oriented parallel and perpendicular to the beam direction, but no measurable effect of polarization on the $^1P/^3P$ ratio was found.

12073 (DOE/ER/10565—10, pp 50-53) **Delayed emission of 2p-1s and 3p-1s X-rays from 40 MeV neon ions ionized in a thin carbon foil.** Palinkas, J.; Maurer, R.J.; Watson, R.L. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

A previous study of the He- and H-like lines of 40 MeV Ne projectiles excited by a thin carbon foil showed that the x-ray spectrum contains only He-like and H-like lines and that the intensities of these lines are sufficient to employ a high resolution curved crystal spectrometer to study the decay curves for individual transitions. Presented are Ne K x-ray spectra excited by passing a beam of 40 MeV ions through a 50 $\mu g/cm^2$ carbon foil. They were taken at 0, 2.3, and 9.1 mm behind the foil and are normalized to the same total integrated charge in the carbon foil. The $1s2p(^3P_1)$-$1s^2(^1S_0)$ transition is a spin-forbidden, metastable, intercombination line and has a lifetime of 1.85×10^{-10} sec[6], whereas the He-like $1s2p(^1P)$-$1s^2(^1S)$, H-like $2p(^2P)$-$1s(^2S)$, and H-like $3p(^2P)$-$1s(^2s)$ transitions are dipole-allowed with lifetimes of 1.13×10^{-13} sec[9], 1.59×10^{-13} sec[9], and 5.98×10^{-13} sec [10], respectively. It is apparent that even at 1 cm (i.e. 0.5 ns) behind the foil, considerable intensity is still detected for the short lifetime transitions indicating that electrons are cascading from very high n levels. Previous measurements and calculations have shown that the decay curves can be described by a power law of the form I = ct/sup -b/, where c and b are constants for a given line. It has been found that b depends on the initial n,l distribution. The measured decay curves for the delayed He-Like $1s2p(^1P)$-$1s^2(^1S)$, H-like 2p-1s and H-like 3p-1s transitions are shown fitted to this power law.

12074 (DOE/ER/10565—10, pp 56-58) **EUV beam-foil spectroscopy of highly ionized argon.** Demarest, J.A.; Palinkas, J.; Watson, R.L. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

Wavelengths, energy level diagrams and lifetimes for highly-ionized heavy ions are of fundamental importance to astrophysical, fusion and laser plasma research. In addition, intense theoretical interest exists for ions with several electrons outside the closed n=1 shell due to the sensitivity of electron correlation effects. This report describes measurements of the extreme ultraviolet radiation resulting from the passage of an 80 MeV argon beam through a thin carbon foil in the wavelength region between 325 and 150 Angstroms. In this region, thirty transitions of the type 2s/sup i/ 2p/sup k/-2s/sup i-1/sp/sup k+1/ (delta n=0) in Be-like, B-like and C-like ions were observed.

12075 (DOE/ER/10565—10, pp 58-62) **Systematics of K X-ray satellite structure excited by heavy-ion impact.** Bandong, B.; Pedrazzini, G.J.; Palinkas, J.; Demarest, J.A.; Parthasaradhi, K.; Watson, R.L. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

Beams of 2 MeV/amu He^+, C^{3+}, O^{3+} and Ar^{8+} were directed onto a closed gas cell with 2.0 mg/cm^2 Ni beam entrance and exit windows and a 65 $\mu g/cm^2$ Ni beam entrance and exit windows and a 65 $\mu g/cm^2$ stretched polypropylene x-ray window. Spectral measurements were performed with a 12.7 cm curved-crystal spectrometer and x rays were detected at 90 degrees to the beam axis. The solid targets employed were NaF (F and Na), crystalline Si, Li_2SO_4 and ZnS (S), and KCl (Cl and K). Free (or quasi-free) atom spectra were measured using the gases HF, Ne, SiH_4, H_2S, HCl, and Ar. To maintain the same geometry for all measurements, the solid target spectra were recorded with the targets mounted inside the gas cell. The spectrometer was energy-calibrated using known values of the Kα/sub 1,2/ peaks in solid targets excited by 5.5 MeV He^+. Accurate peak centroids and areas were determined by means of a least-squares fitting program (FACELIFT). Sample spectra showing the drastic change in satellite intensity distribution going from a solid to a gaseous target are shown for Si and Cl excited by 80 MeV Ar ions.

12076 (DOE/ER/10565—10, pp 62-65) **Ion-excited K X-ray spectra of oxygen.** Bandong, B.; Palinkas, J.; Pedrazzini, G.J.; Watson, R.L. Aug 1985. NTIS, PC A07/MF A01. File Number DE85017620.

In Cyclotron-based nuclear science. Progress report, April 1, 1984-March 31, 1985.

A large body of spectral data on a wide variety of oxygen compounds exists in the literature. However, all of these previous studies were done by electron bombardment or photon fluorescence, and so very little is known about the effects of multiple ionization on the MO structure. The present investigation involves the measurement of oxygen K x-ray spectra excited in various gaseous and solid compounds by bombardment with 2 MeV/a.m.u. ion beams (He to Ar) available from the Texas A & M Variable Energy Cyclotron. Spectral measurements were carried out using a 12.7 cm Johansson-type curved-crystal spectrometer employing a TAP or an RAP crystal. For the case of solid oxygen compounds, alkali and alkaline-earth oxides were used while gaseous targets included O_2, CO_2, and H_2O.

12077 (DOE/ER/10618—19) **Theoretical studies of atomic transitions. Progress report, March 15, 1985-March 14, 1986.** Fischer, C.F. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Computer Science). 1986. Contract AS05-80ER10618. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004507.

A brief description of the research program for atomic studies is given. The program includes an effort to combine the Multi-Configuration Hartree-Fock (MCHF) method with Many-Body Perturbation Theory and the development of a database system for atomic data generated by the atomic structure package. 6 refs. (WRF)

12078 (DOE/ER/13191—2) **Kinetic studies following state selective laser excitation. Progress report, March 15, 1985-March 14, 1986.** Keto, J.W. (Texas Univ., Austin (USA). Dept. of Physics). 1985. Contract FG05-84ER13191. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004996.

Energy transfer studies using two-photon laser-induced fluorescence are reported. The study includes measurements of radiative life-times and state-to-state deactivation rate constants for the xenon $5p^56p$ configuration in collisions with xenon atoms. 25 refs., 6 figs., 2 tabs. (WRF)

12079 (DOE/ER/13192—12) **Electron collisions with positive ions. Progress report, April 1, 1985-March 31, 1986.** Henry, R.J. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). Nov 1985. Contract FG05-84ER13192. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004523.

This report concerns a program of computation of cross sections for electron impact excitation and ionization of ions. The report covers the year from April 1, 1985-March 31, 1986. 15 refs.

12080 (DOE/ER/45162—1) **Study of the interaction of light with sub-micron metallic surfaces. Progress report.** Reifenberger, R. (Purdue Univ., Lafayette, IN (USA). Dept. of Physics). Oct 1985. Contract FG02-84ER45162. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004709.

This research project is devoted to the study of the interaction of laser light with sub-micron metallic surfaces. The fundamental physical process studied is the pthotexcitation of electrons from field emission tips by a focussed Argon-ion laser beam tuned to operate at a particular wavelength. The photoexcited electrons escape into the vacuum by tunnelling through a surface potential barrier which is distorted by the application of a strong electric field. The interest in these experiments lies in the information derived from a study of the final state energy distribution. The shape of this distribution should be influenced by the electronic structure of the solid under study, the quantum mechanical transmission of the electron

through the surface potential barrier and the nature of the photoexcitation process of low photon energies (hω<phi). This research is attempting to address all of these issues. The basic information gained from this research should be relevant for the better design and fabrication of opto-electronic and infrared devices which rely on strong interface electric fields for proper performance. 1 fig.

12081 **(FIAS-R—153) Method for solving the Lippmann-Schwinger equation. I. Single channel case.** Mitroy, J.; McCarthy, I.E.; Stelbovics, A.T. (Flinders Univ. of South Australia, Bedford Park. Inst. for Atomic Studies). May 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700347.

A description is given of a distorted wave method for the solution of the Lippmann-Schwinger equation for electron-atom scattering. The integral equation is solved using a complete set of states defined by the direct static potential of the atom under investigation rather than using the usual plane wave representation. Results for the static-exchange scattering of electrons from helium and argon show significantly improved convergence over plane wave expansion techniques and are of sufficient accuracy to indicate that the method can be generalised to efficiently solve the multi-channel Lippmann-Schwinger equation.

12082 **(IC—85/11) nlm→n'l'm' transition polarizability, magnetizability and susceptibilities for H atom.** Obada, A.S.F.; Mahran, M.H.; Mohamed, Z.E. (International Centre for Theoretical Physics, Trieste (Italy)). Feb 1985. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700341.

A closed analytical form of the polarizability, magnetizability and susceptibilities for nlm→n'l'm' transitions is given. As a special case we obtain the earlier 1s→1s and 1s→2Psub(z) of Babiker et al.

12083 **(IC—85/15) To test photon statistics by atomic beam deflection.** Wang Yuzhu; Chen Yudan; Huang Weigang; Liu Liang. (International Centre for Theoretical Physics, Trieste (Italy)). Feb 1985. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700348.

There exists a simple relation between the photon statistics in resonance fluorescence and the statistics of the momentum transferred to an atom by a plane travelling wave [Cook, R.J., Opt. Commun., 35, 347(1980)]. Using an atomic beam deflection by light pressure, we have observed sub-Poissonian statistics in resonance fluorescence of two-level atoms.

12084 **(IC—85/23) Collision kernels in the eikonal approximation for Lennard-Jones interaction potential.** Zielinska, S. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1985. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700349.

The velocity changing collisions are conveniently described by collisional kernels. These kernels depend on an interaction potential and there is a necessity for evaluating them for realistic interatomic potentials. Using the collision kernels, we are able to investigate the redistribution of atomic population's caused by laser light and velocity changing collisions. In this paper we present the method of evaluating the collision kernels in the eikonal approximation. We discuss the influence of the potential parameters Rsub(o)sup(i), epsilonsub(o)sup(i) on kernel width for a given atomic state. It turns out that unlike the collision kernel for the hard sphere model of scattering the Lennard-Jones kernel is not so sensitive to changes of Rsub(o)sup(i) as the previous one. Contrary to the general tendency of approximating collisional kernels by the Gaussian curve, kernels for the Lennard-Jones potential do not exhibit such a behaviour.

12085 **(ITEP—111(1984)) Influence of quark configurations on the spectrum of the hadronic atom.** Kerbikov, B.O. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700343.

A study is made of the influence of the quark configurations on the Coulomb levels of the hadronic atom. An equation is obtained for the level shift with the inclusion of quark degrees of freedom. This equation is then analyzed in a model which admits an explicit solution. The conditions are formulated under which the coupling to the quark channel results in the reshuffling of hadronic atom spectrum. Some brief remarks are made on the experimental data on the 1S level shift in K^-p and anti pp atoms.

12086 **(JINR—E-7-84-142) Auger electron spectra in 5.5 MeV/amu Nesup(q+) and Arsup(q+) ion impact on Ne.** Berenyi, D.; Hock, G.; Kadar, I.; Riez, S.; Shchegolev, V.A.; Sulik, B.; Varga, D.; Vegh, J.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700350.

A study of Ne K-Auger spectra induced by 5.5 MeV/amu Ne^{3+}, Ne^{10+}, Ar^{6+} and Ar^{17+} heavy ions on Ne is presented. Some average quantities (the centroid energy of KLL Auger spectra, the average number of L vacancies produced simultaneously with the K vacancy, the effective charge of the projectile in the actual process, Zsub(eff), the satellite to total intensity ratio) characterizing the KLsup(n) ionization process have been extracted from these spectra. Relative K-shell ionization cross sections and KLM to KLL cross section ratios have also been evaluated. The deduced experimental Zsub(eff) values have been compared to the results of plane wave Born approximation (PWBA) and binary encounter approximation (BEA) calculations. A simple model calculation is made in an attempt to interpret the variation of the probability for the ejection of an L-shell electron (Psub(L)) as a function of Zsub(eff)/vsub(p). Some statements regarding individual lines and groups in the Auger spectra are made.

12087 **(JINR—R-1-84-17) Measurement of the pμ-atom scattering cross section in gaseous hydrogen.** Bystritskij, V.M.; Dzhelepov, V.P.; Petrukhin, V.I.; Rudenko, A.I.; Suvorov, V.M.; Fil'chenkov, V.V.; Khovanskij, N.N.; Khomenko, B.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700344.

Submitted to the journal Sov. Phys. -JETP.

In the experiment performed on the Muon beam of the Dubna synchrocyclotron with a gaseous hydrogen at 41 atm pressure, the cross section for pμ-atom scattering on hydrogen molecules has been measured. A value $\sigma(p\mu + H_2) = (42 +- 8) \times 10^{-31}$ cm^2 has been obtained, the corresponding cross section for the scattering on free protons is then $\sigma(p\mu + p) = (17.4 +- 3.3) \times 10^{-31}$ cm^2.

12088 **(LA-UR—85-4307) Elements of a dialogue between nonlinear models in condensed matter and biophysics.** Bishop, A.R.; Lomdahl, P.S.; Kerr, W.C. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 10p. (CONF-850784—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004736.

From Computer analysis for life science; Okayama, Japan (9 Jul 1985).

We indicate some of the emerging thematic connections between strongly nonlinear effects in condensed matter and biological materials. These are illustrated with model studies of: (1) structural phase transitions in anisotropic lattices; and (2) finite temperature effects on self-trapped states in vibron-phonon models of α-helix proteins. 13 refs., 8 figs.

12089 **(LYCEN—8462) Constraint quantization: case of the hydrogen atom.** Kibler, M.; Negadi, T. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Oct 1984. 37p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE86750312.

The connection between the R^3 hydrogen atom and R^3 (an operation in a mathematical system indicating the product of two elements) R^3 harmonic oscillator or free-particle systems subjected to constraints is studied for the discrete spectrum, the continuous spectrum, and the zero-energy point of the hydrogen atom. This study is conducted in the framework of two complementary approaches: a local (or infinitesimal) approach by bosonization of the

Pauli equations and a global (or partial-differential-equations) approach by applying a nonbijective canonical transformation (viz., the Kustaanheimo-Stiefel transformation) to the Schroedinger equation of the R^3 hydrogen atom. The case of the hydrogen atom in a uniform electromagnetic field (Stark and Zeeman effects) is also considered.

12090 **(TRI-PP—83-88) Muonium addition reactions to aromatic solutes. Application of the Hammett equation in the production of muonium-radicals.** Stadlbauer, J.M.; Ng, B.W.; Genti, R.; Walker, D.C. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700345.

Reaction rate constants of 0.3 to 1.1 x 10sup(10) Msup(-1) ssup(-1) were determined for the reaction of muonium (μsup(+)esup(-),Mu) with seven aromatic solutes in dilute aqueous solution at approximately 295K. The reaction was deduced to be that of addition to the benzene ring to form cyclohexadienyl radicals. On comparison with the analogous H-atom reactions, the kinetic isotope effects were generally about three, equal to the mean thermal velocity ratio of Mu/H. When analyzed through the Hammett equation there were serious discontinuities but a rho value of +0.6 was deduced, not inconsistent with attack by a mildly electron-donating neutral atom forming only free radical intermediates.

12091 **(TRI-PP—83-98) Muonium formation in vapors.** Arseneau, D.J.; Garner, D.M.; Senba, M.; Fleming, D.G. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700346.

The fractions of positive muons thermalizing in vapors as either the muonium atom (fsub(M)) or in diamagnetic environments (fsub(D)) have been measured in water, methanol, hexane, c-hexane, the chlorinated methanes and in TMS, in the pressure range from approximately 0.1 to approximately 2.5 atm. There is a marked difference in every case in comparison with the corresponding fractions (Psub(M),Psub(D)) measured in condensed media, with approximately 80 percent of incident muons forming muonium in the vapor phase compared to approximately 20 percent in the corresponding condensed phases. CClsub(4) appears somewhat anomalous in that it shows an unusually small muonium fraction in the vapor (fsub(D) approximately fsub(M) = 0.5) and an unusually large diamagnetic fraction in the liquid (Psub(D) = 1.0); these results can be attributed to large hot atom cross sections extending to the thermal regime, manifest as a relatively fast thermal rate constant for Mu + CClsub(4) (ksub(MU) = (2.9 +- 0.8) x 10sup(8) Msup(-1) ssup(-1)). The vapor phase results can be understood in terms of a charge exchange/hot atom (ion) model, providing also a likely explanation for observed pressure dependent fsub(D)'s in hexane, c-hexane and TMS at low (<0.5 atm) pressures in terms of termolecular processes, in analogy with some hot tritium studies. In the condensed phase, however, the present vapor phase results indicate that hot atom reactions cannot account for more than about 30 percent of the much larger diamagnetic fractions seen, strongly suggesting therefore that radiation induced spur effects play a dominant role in determining thermal muon fractions in condensed media.

12092 **(UCRL—93471) High-resolution absorption spectrum of the $6^1S_0 \rightarrow 6^3P_1$ transition in mercury with a Cw dye laser.** Crane, J.K.; Erbert, G.V.; Mostek, S.D.; Kerlin, R.C.; Paisner, J.A. (Lawrence Livermore National Lab., CA (USA)). 13 Nov 1985. Contract W-7405-ENG-48. 14p. (CONF-851185—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86003492.

From International laser science conference; Dallas, TX, USA (18 Nov 1985).

Using a stabilized single-frequency commercial dye laser and an external cavity doubling crystal, we have measured the isotope shifts of mercury for the $6^1S_0 \rightarrow 6^3P_1$ transition with an accuracy of 4 MHz. We describe the method for generating single-frequency light at 2537 A and compare the results of our measurements of the isotope shifts with previous work. 7 refs., 5 figs., 1 tab.

12093 **(UFPB-DF—13/84) Zeeman effect in highly excited atoms: 2. Three-dimensional case.** Baseia, B.; Medeiros e Silva Filho, J. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica). 1984. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700342.

A previous result, found in two-dimensional hydrogen-atoms, is extended to the three-dimensional case. A mapping of a four-dimensional space R^4 onto R^3, that establishes an equivalence between Coulomb and harmonic potentials, is used to show that the exact solution of the Zeeman effect in highly excited atoms, cannot be reached.

12094 **Magnetic-field extraction and filamentation of high-current electron beams.** Freeman, J.R.; Poukey, J.W.; Wagner, J.S.; Coats, R.S. (Plasma Theory Division, Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **59**: No. 3, 725-730(1 Feb 1986).

Beam extraction simulations for high-voltage, immersed source accelerators are compared with analytic theory and experiment. dynadIsc, a new nonlinear beam propagation code, is described and applied to the initial few meters of propagation in 1 atm air. The dynadIsc results indicate that filamentation is the fastest growing instability. The filamentation changes the beam current density profile from an annular to a quasi-uniform distribution.

12095 **Photoionization studies of HgKr and HgXe.** Liao, C.L.; Ng, C.Y. (Ames Laboratory, U. S. Department of Energy and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Chemical Physics;* **84**: No. 3, 1142-1145(1 Feb 1986). Contract W-7405-ENG-82.

Photoionization efficiency data for $HgKr^+$ and $HgXe^+$ have been obtained in the region of 730—1290 A. The ionization energies (IE) of HgKr and HgXe are determined to be 10.056 +- 0.012 (1233 +- 1.5 A) and 9.709 +- 0.011 eV (1277 +- 1.5 A), respectively. Using these values, the known dissociation energies of HgKr and HgXe, and the IE of Hg, the binding energies for the ground-state mercury-rare gas molecular ions are calculated to be 0.393 +- 0.013 eV for $HgKr^+$ and 0.748 +- 0.013 eV for $HgXe^+$. By analyzing the shifts in energy between corresponding autoionization peaks observed in the Kr^+, $HgKr^+$, Xe^+, and $HgXe^+$ spectra and by assuming the charge induced-dipole interaction to be the dominant interaction at the equilibrium bond distances for HgKr and HgXe, the equilibrium bond distances for HgKr and HgXe are deduced to be 3.98 and 4.23 A, respectively. The latter values are in excellent agreement with values determined by previous spectroscopic studies.

12096 **Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet.** Ray, D.; Robinson, R.L.; Gwo, D.; Saykally, R.J. (Department of Chemistry and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **84**: No. 3, 1171-1180(1 Feb 1986).

We report the development of a very sensitive laser technique for measuring the vibrational motions in van der Waals bonds. This new technique has been used to detect the lowest perpendicular bending vibration in ArHCl near 35 cm^{-1} with signal-to-noise ratios > or =10^4 and with resolution of nuclear hyperfine structure. A total of 80 Stark-hyperfine components of the R(0), Q(1), Q(2), rotational lines have been measured with a precision of < or =1 MHz and analyzed by least squares techniques to obtain precise values for the vibrational band origin [ν_0 = 1018 731.20(31) MHz], the dipole moment [μ' = 0.260 26(11) D], the effective rotational constant [(B'+C')/2 = 1696.70(22) MHz], the l-type doubling constant [q/sub l/ = -50.90(35) MHz], and the ^{35}Cl quadrupole coupling constants [eqQ/sup prime//sub a/a = -6.5(4.1) MHz, eqQ/sup prime//sub b/b-eqQ/sup prime/ /sub c/c = -74.4(2.2) MHz] in the excited perpendicular (l = +- 1) bending state. Interpretation of these constants indicates a strongly bent average geometry (θ>51°) for the excited state. These measurements strongly support the results obtained from empirical potential surfaces by Hutson, and Howard and Hutson.

12097 **Calculated νZ (inversion) spectrum of H_3O^+.** Liu, D.; Oka, T.; Sears, T.J. (Department of Chemistry and Department of Astronomy and Astrophysics, The University of Chicago, Chicago, Illinois 60637). *Journal of Chemical Physics;* **84**: No. 3, 1312-1316(1 Feb 1986).

We report the observation and assignment of a number of vibration—rotation transitions within $1^- \leftarrow 1^+$ band of H_3O^+. The data are analyzed together with previously published measurements to yield a consistent set of rotational parameters that accurately reflects the vibration—rotation spectra involving the four lowest levels associated with the ν_2 vibration of the ion. The analysis enables a precise estimate of the inversion splitting and the associated inversion-rotation spectrum of H_3O^+ which occurs in the far infrared.

12098 **State-to-state vibrational excitation of I_2 in collisions with H_2 and D_2.** Hall, G.; Liu, K.; McAuliffe, M.J.; Giese, C.F.; Gentry, W.R. (Chemical Dynamics Laboratory, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Chemical Physics;* **84**: No. 3, 1402-1407(1 Feb 1986). Contract AC02-83ER13063.

We have measured the energy dependence of cross sections for I_2 vibrational excitation in collisions with H_2 and D_2 over the kinetic energy range from threshold to about 0.46 eV for D_2 and 0.29 eV for H_2. D_2 is generally less efficient than He in exciting I_2, probably because of a softer repulsive wall in the effective interaction potential. An exception is the low-energy cross section for $v = 0 \rightarrow 2$ excitation, which might be enhanced for D_2 collisions because of an accidental resonance in energy with the D_2 ($j = 4 \rightarrow 2$) rotational transition. The $v = 0 \rightarrow 1$ cross sections for H_2 collisions show a sharp and as yet unexplained feature at an energy 0.014 eV above threshold.

12099 **Fine structure effect on the charge transfer reaction of Ar^+ ($^2P_{3/2}$, $^2P_{1/2}$) + N_2 ($X\ ^1\Sigma^+_g$, $v = 0$).** Liao, C.L.; Xu, R.; Ng, C.Y. (Ames Laboratory,)/ sup b/ U. S. Department of Energy and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Chemical Physics;* **84**: No. 3, 1948-1950(1 Feb 1986). Contract W-7405-ENG-82.

The relative spin-orbit-state-selected total charge transfer cross sections, σ_3/sub //$_2$ and σ_1/sub //$_2$, for the reactions, Ar^+ (^{2}P/sub 3/2,1/2/) + N_2 ($X\ ^1$summation$^+$/sub g/ ,v = 0) $\rightarrow$ Ar + N^+_2 at the center-of-mass collision energy (E/sub c.m./) range of 0.41—164.7 eV, have been determined using the photoionization and crossed ion—neutral beam methods. The kinetic energy dependences for σ_1/sub //$_2$/σ_3/sub //$_2$ is found to exhibit a minimum at E/sub c.m./roughly-equal3.3 eV, an observation consistent with the prediction of a recent semiclassical theoretical calculation of Spalburg and Gislason.

12100 **Silicon analog of benzene—hexasilabenzene (Si_6H_6).** Clabo D.A. Jr.; Schaefer H.F. III. (Department of Chemistry and the Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **84**: No. 3, 1664-1669(1 Feb 1986).

Ab initio molecular electronic structure theory has been applied to the D/sub 6h/- symmetry isomer of Si_6H_6. Self-consistent-field (SCF) theory has been applied in conjunction with double zeta (DZ) and double zeta plus silicon 3d (DZ+d) basis sets. The DZ+d basis set may be designated Si(11s 7p 1d/6s 4p 1d), H (4s/2s). The structure of hexasilabenzene is predicted to be: r/sub e/(Si—Si) = 2.223 A, r/sub e/(Si—H) = 1.476 A (DZ SCF); r/sub e/(Si—Si) = 2.205 A, r/sub e/(Si—H) = 1.463 A (DZ+d SCF). Vibrational frequencies have been predicted at the DZ SCF level, at which the DZ SCF structure is a true minimum. However, the lowest vibrational frequency is predicted to be only 10 cm^{-1}.

12101 **Electron affinity of hydroxyl radical.** Chipman, D.M. (Radiation Laboratory, University of Notre Dame, South Bend, Indiana 46556). *Journal of Chemical Physics;* **84**: No. 3, 1677-1682(1 Feb 1986).

Although the hydroxyl radical is known experimentally to strongly bind an electron, Hartree—Fock calculations predict the excess electron to be unbound. The electron affinity of hydroxyl radical is therefore entirely due to differential effects of electron correlation between the neutral and the anion. Provided that sufficient electron correlation is included in the wave functions, it is found that basis set requirements for semiquantitative determination of this property are modest. A standard double zeta Gaussian basis augmented by one shell of diffuse functions on each atom is capable of giving over 75% of the experimental electron affinity. Addition of polarization functions makes a small correction leading to recovery of over 80% of experiment. Convergence with respect to enlargement of the basis set is very slow beyond this point. Through comparison of a series of calculations containing different levels of configuration interaction, it is found that the electron affinity is largely due to certain types of double excitations from the dominant RHF-like reference determinant. One kind involves only intrapair double excitations and is properly regarded as representing intrapair correlations. The other kind, which is just as important, involves products of two single excitations from different pairs. These then represent interpair correlations arising from simultaneous intrapair single excitations. The GVB method leads to poor results, due to the neglect of the latter kind of correlation. The pi electrons give most of the EA, the interaction of the pi electrons with the sigma bonding pair makes a small but significant contribution, and the 1s and 2s oxygen pairs have little effect.

12102 **Theory of Ksup(n)Lsup(ν) multiple vacancy production by heavy ions.** Becker, R.L.; Ford, A.L.; Reading, J.F. (Oak Ridge National Lab., TN, USA; Texas A and M Univ., College Station, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 1-6(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Observation of intensities of Ksub(α) X-ray or Auger satellites and hypersatellites together with fluorescene yields provides knowledge of KLsup(ν) and K^1Lsup(ν) vacancy distributions produced by ion-atom collision. The traditional theory used since about 1972 employs a single-particle model and a weak-coupling ionization approximation. We review our recent extensions of the theory to include Pauli correlation in the independent-Fermi-particle model, a unitary collision theory in the first Magnus and coupled-channels approximations, electron transfer to the projectile, and contributions from shake-off which interfere with the collision-induced amplitudes.

12103 **Time dependent Hartree-Fock theory of ion-atom collisions: Application to F^{9+} /Ne.** Bottcher, C. (Oak Ridge National Lab., TN, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 7-11(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117--20.

Atomic collisions at intermediate energies are formulated in terms of a time dependent self-consistent field. Numerical problems which arise in applying the formalism to heavy ions and atoms are discussed. Results are presented on charge capture and ionization in F^{9+} + Ne collisions.

12104 **Investigations of molecular orbitals with accel-decel beams.** Meron, M.; Johnson, B.M.; Jones, K.W.; Schuch, R.; Schmidt-Boecking, H.; Tserruya, I. (Brookhaven National Lab., Upton, NY, USA; Heidelberg Univ., Germany, F.R., Physikalisches Inst.; Frankfurt Univ., Germany, F.R., Inst. fuer Kernphysik; Weizmann Inst. of Science, Rehovoth, Israel). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 64-68(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as report BNL--35312; CONF-841117--29.

Quasimolecular transition energies can be found directly from the impact-parameter dependence of interference structure observed in measured K X-ray spectra. As these experiments require a K-vacancy bearing projectile at collision velocities small compared to the equivalent K-shell electron velocity, the accel-decel tech-

nique has to be used. Such an experiment was performed at the BNL Tandem Accel-Decel Facility for collisions of Cl^{10+} with Ar at energies ranging from 2.5 to 20 MeV. A new method of analysis using the uniform asymptotic approximation is described here. Quasimolecular transition energies derived using this method are compared to results of a previous analysis based on the determination of the relative positions of maxima and minima in the interference patterns.

12105 **Spectroscopy of quasimolecular X-rays with H-like decelerated ions.** Schmidt-Boecking, H.; Schadt, W.; Schuch, R.; Hoffmann, R.; Justiniano, E.; Schulz, M.; Tserruya, I.; Johnson, B.; Jones, K.W.; Meron, M. (Frankfurt Univ., Germany, F.R., Inst. fuer Kernphysik; Heidelberg Univ., Germany, F.R., 2. Physikalisches Inst.; Weizmann Inst. of Science, Rehovoth, Israel; Brookhaven National Lab., Upton, NY, USA; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 69-74(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as report BNL--35643; CONF-841117--44.

The quasimolecular $2p\pi$-1ssigma transition energy as a function of the internuclear distance is obtained from the interference structure observed in quasimolecular K X-ray spectra from low energy H-like projectiles measured at certain impact parameters.

12106 **Indirect processes in electron impact ionization of multiply-charged ions.** Gregory, D.C. (Oak Ridge National Lab., TN, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 87-91(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117--39.

Recent research efforts have assembled a steadily increasing array of measurements and calculations of electron impact ionization of multiply-charged ions. Significant disagreement is often found, however, between experimental results and theory due to the influence of a number of indirect processes observed in the experiments but not included in the calculations. Some of the most important of these indirect ionization processes are described and examples are discussed. New data for electron impact single-ionization of Kr^{2+} are presented in the energy range from below threshold (36 eV) to 1500 eV, and compared with related measurements and with theory.

12107 **Correlated two electron effects in collisions of multiply-charged Au ions with He.** Datz, S.; Bottcher, C.; Andersen, L.H.; Hvelplund, P.; Knudsen, H. (Oak Ridge National Lab., TN, USA; Aarhus Univ., Denmark. Inst. of Physics). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 116-119(15 May 1985). (CONF-841117—). Contract AC05-84OR21400.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117--19.

We have studied the fate of electrons released in collisions between highly charged Ausup(q+) ions (20 MeV) and He atoms and find that the large transfer ionization (TI) cross section observed can be accounted for by the transfer of two electrons to a highly correlated state on the Au projectile followed by the loss of one electron to the continuum. Autoionization lines are also observed, but they are attributable to electron transfer accompanied by core excitation (TE).

12108 **Coincidence techniques to study electron emission in ion-atom collisions.** DuBois, R.D. (Battelle Pacific Northwest Labs., Richland, WA, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 120-123(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as report PNL-SA--12414; CONF-841117--24.

Electron emission as a function of emission angle and electron energy provides a very sensitive probe for testing our theoretical understanding of ion-atom collisions. For fast proton impact on gaseous targets the Born approximation has been shown to work quite well. However, for structured particle impact a comparison with theory is more difficult. The experimental observation of the total electron emission must be compared with the sum of the theoretical calculations for projectile-only, target-only, and simultaneous projectile-target ionization. Thus a set of experiments will be discussed in which the electron emission is being recorded in coincidence with the post-collision projectile charge state. He^+-Ar is being studied for impact energies between 1 and 2 MeV. Coincidences between emitted electrons and stripped projectiles provide information about projectile ionization while information about simultaneous projectile-target ionization is obtained from stripped projectile-target ion coincidences.

12109 **Electron capture to the continuum from atomic hydrogen.** Glass, G.A.; Engar, P.; Berry, S.D.; Breinig, M.; Deserio, R.; Elston, S.B.; Sellin, I.A. (Oak Ridge National Lab., TN, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 138-141(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117--43.

The first known measurement of the differential cross section for electron capture to the continuum (ECC) from atomic hydrogen is presented. A 12 MeV beam of C^{6+} ions traversed a static target of atomic hydrogen produced by an electron impact heated dissociation oven. The resulting ECC spectrum was obtained with a channel electron multiplier detector mounted at the exit of a 160° spherical sector electrostatic spectrometer with an angular acceptance of 2°. The ECC spectrum clearly shows the asymmetry generally associated with ECC spectra from gaseous targets. The ratio of the singly differential cross-section of H to that of H_2 was found to be 0.80.

12110 **L-shell X-ray production cross sections in Nd, Gd, Ho, Yb, Au and Pb for 25-MeV carbon and 32-MeV oxygen ions.** Andrews, M.C.; McDaniel, F.D.; Duggan, J.L.; Mehta, R.; Lapicki, G.; Miller, P.D.; Pepmiller, P.L.; Krause, H.F.; Rosseel, T.M.; Rayburn, L.A. (North Texas State Univ., Denton, USA. Dept. of Physics; East Carolina Univ., Greenville, NC, USA. Dept. of Physics; Oak Ridge National Lab., TN, USA. Physics Div.; Texas Univ., Arlington, USA. Dept. of Physics). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 181-185(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117--48.

L-shell X-ray production cross sections in $_{60}$Nd, $_{64}$Gd, $_{67}$Ho, $_{70}$Yb, $_{79}$Au and $_{82}$Pb have been measured for incident 25 MeV $_6{}^{13}$Csup(+q) (q=4, 5, 6) and 32 Me $V_8{}^{16}$Osup(+q) (q=5, 7, 8) ions. Measurements were made on targets ranging in thickness from 1 to 100$\mu g/cm^2$. Enhancement in the L-shell X-ray production cross-sections for projectiles with one or two K-shell vacancies over those for projectiles with no K-shell vacancies is observed. The sum of direct ionization to the continuum (DI) plus electron capture (EC) to the L, M, N... shells and EC to the K-shell of the projectile have been extracted from the data. Calculations in the first Born approximation are proportional 10 times larger than the data. Predictions of the ECPSSR theory that accounts for the energy-loss, Coulomb deflection, perturbed-stationary state and relativistic effects are in good agreement with the data for both ions.

12111 **M-shell electron capture and direct ionization of gold by 25-MeV carbon and 32-MeV oxygen ions.** Andrews, M.C.; McDaniel, F.D.; Duggan, J.L.; Miller, P.D.; Pepmiller, P.L.; Krause, H.F.; Rosseel, T.M.; Rayburn, L.A.; Mehta, R.; Lapicki, G. (North Texas State Univ., Denton, USA. Dept. of Physics; Oak Ridge National Lab., TN, USA. Physics Div.; Texas Univ., Arlington, USA. Dept. of Physics; East Carolina Univ., Greenville, NC, USA. Dept. of Physics). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 186-189(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117-47.

M-shell X-ray production cross sections have been measured for thin solid targets of Au for 25 MeV $_{6}^{12}$Csup(q+) (q=4, 5, 6) and for 32 MeV $_{8}^{16}$Osup(q+) (q=5, 7, 8). The microscopic cross sections were determined from measurements made with targets ranging in thickness from 0.5 to 100 μg/cm². For projectiles with one or two K-shell vacancies, the target M-shell X-ray production cross-sections are found to be enhanced over those by projectiles without a K-shell vacancy. The sum of direct ionization to the continuum (DI) and electron capture (EC) to the L, M, N... shells and EC to the K-shell of the projectile have been extracted from the data. The results are compared with the predictions of first Born theories, i.e. PWBA for DI and OBK of Nikolaev for EC and the ECPSSR approach that accounts for energy loss, Coulomb deflection and relativistic effects in the perturbed stationary state theory.

12112 **Synchrotron radiation production and trapping of highly charged ions.** Johnson, B.M.; Jones, K.W.; Meron, M. (Brookhaven National Lab., Upton, NY, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 313-317(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as report BNL–35311; CONF-841117–30.

Wiggler-enhanced synchrotron radiation will soon be available at dedicated facilities such as the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory. Two recent proposals to study highly-charged ions produced by successive photoionization with broad-band synchrotron radiation are based on the design parameters of the NSLS X-ray ring. Previous calculation indicated that in a suitable Kingdon trap, concentrations of 5 . $10^{7}Ar^{18+}$ ions per cm can be attained in a few seconds trapping time and that in a Penning trap 5 . $10^{3}Ar^{17+}$ ions could be stored at near thermal energies (300 K) to study, for example, charge transfer collision processes for cold, highly-charged ions. Here the previous work is reviewed and the earlier calculations are extended. The addition of an axial magnetic field to a Kingdon trap is shown to improve expected PHOBIS performance.

12113 **Convoy electron production by heavy ions in solids.** Sellin, I.A. (Oak Ridge National Lab., TN, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 156-160(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117–38.

The term 'convoy' electron refers to those electrons ejected in fast ion-atom and ion-solid collisions closely matched in vector velocity to that of the incident heavy particles responsible for their ejection. Similarities and differences among electrons ejected into such states through binary electron capture to continuum and electron loss to continuum processes in single ion-atom encounters are compared and contrasted to more complex ejection processes occurring in solid targets. Puzzles posed by the apparent strong projectile Z dependence but weak emergnet ion charge dependence of the yield in the case of solid targets are reviewed. Very recent progress in resolving these puzzles has been made by recent observations that the apparent mean free path for electron scattering out of the forward direction within the target is observed to be an order of magnitude greater than that for free electrons of equal velocity provided the projectile charge is high.

12114 **Ultrahigh-resolution studies of heavy-ion induced X-ray satellite emission.** Vane, C.R.; Kaellne, E.; Kaellne, J.; Morford, G.; Raman, S.; Smith, M.S. (Oak Ridge National Lab., TN, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 190-194(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117–40.

We studied Ksub(α) X-ray emission from sulfur compounds and L X-ray emission from molybdenum metal induced by 34 MeV Clsup(q+) ion bombardment. The measurements were made with an energy resolution high enough to observe the principal multiplet components within the various satellite groups. The data were taken with a narrow-bandwidth, very-high-resolution, Van Hamos curved-crystal spectrometer using a position sensitive detector. The sulfur spectra display proportional 1 eV fine structures which differ markedly for the various targets. Even in these preliminary studies, the data show promise for yielding new information for chemical analysis. To continue to progress in this area, we have designed and are constructing a new, more versatile Van Hamos spectrometer.

12115 **Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra.** Rosseel, T.M.; Dale, J.M.; Hulett, L.D.; Krause, H.F.; Pepmiller, P.L.; Raman, S.; Vane, C.R.; Young, J.P. (Oak Ridge National Lab., TN, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 195-197(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117–37.

High-resolution measurements of L, heavy-ion-induced X-ray satellite emission (HIXSE) spectra have been obtained for Zr and Nb alloys and compounds. Variations in the relative intensity profile of the satellite lines were observed and are attributed to the influence of the valence-electron distribution or chemical environment of the emitting element. Although these spectra are more complex than the Ksub(α), results are presented which demonstrate that the satellite spectra can be correlated with the valence-electron density of the target. Chemical effects on the Au and Pb M X-ray satellite spectra were also observed. These results indicate that HIXSE can probe the chemical nature of intermediate and high Z materials. The effect of projectile energy on the L X-ray satellites is also examined.

12116 **Charge changing cross sections of relativistic uranium.** Gould, H.; Greiner, D.; Lindstrom, P.; Symons, T.J.M.; Crawford, H.; Thieberger, P.; Wegner, H. (California Univ., Berkeley, USA. Div. of Materials and Molecular Research; California Univ., Berkeley, USA. Div. of Nuclear Science; California Univ., Berkeley, USA. Space Sciences Lab.; Brookhaven National Lab., Upton, NY, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 32-35(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as report LBL–18731; CONF-841117–34.

We report equilibrium charge state distributions of uranium at energies of 962 MeV/nucleon, 437 MeV/nucleon and 200 MeV/nucleon in low Z and high Z targets and the cross sections for U^{92+} reversibleU^{91+} and U^{91+} reversibleU^{90+} at 962 MeV/nucleon and 437 MeV/nucleon. Equilibrium thickness Cu targets produce approx.=5% bare U^{92+} at 200 MeV/nucleon and 85% U^{92+} at 962 MeV/nucleon.

12117 **Final-charge-state-dependence in the production of foil-excited heavy Rydberg atoms.** Kanter, E.P.; Koenig, W.; Faibis, A.; Zabransky, B.J. (Argonne National Lab., IL, USA. Physics Div.). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 36-38(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Studies of foil-excited fast (MeV/amu) heavy ions have demonstrated large yields of high Rydberg atoms formed in such beams. Further experiments have suggested a strong target-thickness dependence of the yields of such atoms. In an effort to better understand these results, we have measured the yields of Rydberg atoms (n proportional 100-200) in foil-excited ^{32}S ions at an incident energy of 125 MeV. The Rydberg atoms were field-ionized in a longitudinal electric field (proportional5 kV/cm) and the detached electrons were detected in coincidence with the remaining charge-state-analyzed ionic cores. The experiments show that while the yields of foil-excited Rydberg atoms depend strongly on the incident ionic charge state and the target thickness, they are relatively insensitive to the final charge states. These results show the importance of bulk processes over surface effects.

12118 **Excited state populations and charge-exchange of fast ions in solids.** Miller, P.D.; Sofield, C.J.; Woods, C.J.; Cowern, N.E.B.; Bridwell, L.B.; Moak, C.D.; Gregory, D.C.; Jones, C.M.; Alton, G.D.; Pepmiller, P.L. (Oak Ridge National Lab., TN, USA. Physics Div.; UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.; Southwest Missouri State Univ., Springfield, USA. Physics Dept.; Kansas State Univ., Manhattan, USA. Dept. of Physics). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 225-227(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117--52.

Excited state populations and charge state fractions of 445 MeV Cl ions have been measured for a range of thicknesses of solid C targets. Cross sections for electron capture, loss, excitation and excited state quenching have been determined and these data are found to predict a quantitative difference between equilibrium charge state distributions from gases and solids for a special case of the Bohr-Lindhard density effect model.

12119 **Negative-lithium emission from a tungsten surface in a plasma.** Stearns, J.W.; Pyle, R.V. (Lawrence Berkeley Lab., CA). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **3**: No. 3, 1243-1244(May-Jun 1985). Contract AC03-76SF00098.

Summary abstract.

The authors report the observation of Li^- from a surface in a He-Li plasma. The apparatus consists of an arc-discharge chamber with a small tungsten plate opposite a collimated beam line and momentum analyzer. The plate is biased negatively with respect to the plasma to accelerate positive ions from the plasma into, and negative ions away from, the surface. For this experiment, the arc was initiated with helium gas. The discharge heated a small crucible filled with lithium metal to introduce lithium vapor and form a composite plasma. The discharge was a bright rose color when the best Li^- yield was obtained. A spectrum is shown with Li^- peaks (composed of three parts due to instrumental constraints). The angular resolution (+/- 2°) permitted observation of only that negative ion current emitted normal to the surface. The plasma sheath causes all very low-energy Li^- ions to be accelerated in this direction, while backscattered, higher energy ions are emitted in a larger cone. 4 references, 2 figures.

12120 **Collectivity of ^{160} ^{161}Yb at high spin.** Fewell, M.P.; Johnson, N.R.; McGowan, F.K.; Hattula, J.S.; Lee, I.Y.; Baktash, C.; Schutz, Y.; Wells, J.C.; Riedinger, L.L.; Guidry, M.W.; Pancholi, S.C. (Oak Ridge National Lab., TN). *Physical Review [Section] C: Nuclear Physics;* **31**: No. 3, 1057-1060(Mar 1985). Contract AC05-84OR21400.

Lifetimes of high-spin states in ^{160} ^{161}Yb have been measured by the recoil-distance technique and, from these, changes in the nuclear shape due to the alignment of quasiparticles have been deduced. It is observed that the addition of the favored i/sub 13/2/ quasineutron causes a reduction in collectivity at large rotational frequencies. This reduction is interpreted as due to induced triaxiality and is much larger than predicted by theory.

12121 **Positive heavy-ion sources.** Clark, D.J. (Lawrence Berkeley Lab., Berkeley, CA). pp 3-47 of Treatise on heavy-ion science: Vol. 7. Instrumentation and techniques. Bromley, D.A. New York, NY; Plenum Press (1985).

This chapter reviews the principles of ion production and the types of sources used on many present positive heavy-ion accelerators and other systems. "Heavy" ions are defined as those heavier than helium. Topics considered include the production of ions (electron bombardment, stripping of fast ions, surface ionization), beam extraction, beam focusing, beam diagnostics, and source descriptions (low charge state sources, present high charge state sources, advanced high charge state sources, short pulse sources).

12122 **Monte Carlo sampling of Compton scatter off moving electrons.** Booth, T.E.; Hendricks, J.S. (Los Alamos National Lab., NM). *Nuclear Science and Engineering;* **90**: 248-255(1985).

A method of sampling the Wienke formula for Compton scattering in Monte Carlo calculations has been developed. The Wienke formula differs from the well-known Klein-Nishina formula in that is considers electrons in relativistic Maxwellian motion. The proposed sampling method for the Wienke formula is a rejection technique similar to Kahn's method for the Klein-Nishina formula.

12123 **Truncation-induced relaxations of a high-index surface: Al(311).** Noonan, J.R.; Davis, H.L.; Erley, W. (Oak Ridge National Lab., TN). *Surface Science;* **152/153**: 142-148(1985). Contract AC05-84OR21400.

The atomic structure of the Al(311) surface was determined using Low Energy Electron Diffraction (LEED). The surface unit cell was found to be in lateral registry with the bulk lattice. However, there are large vertical relaxations of the first and second atomic planes perpendicular to the surface. The first interplanar spacing, d_{12}, is contracted by 13% relative to the bulk value and d_{23} is expanded by 9%. Even though no lateral displacements were found to exist at the surface, the comparison of calculated and experimental LEED spectra was found to be sensitive to lateral displacements, which is contrary to commonly held beliefs concerning LEED analysis. 11 references, 3 figures, 1 table.

12124 **Composite sequences for efficient double-quantum excitation over a range of spin coupling strengths.** Barbara, T.M.; Tycko, R.; Weitekamp, D.P. (Univ. of California at San Diego, La Jolla). *Journal of Magnetic Resonance;* **62**: 54-64(1985). Contract AC03-76SF00098.

It is demonstrated theoretically and experimentally that double-quantum coherence can be excited with nearly maximal efficiency over a large range of spin coupling strengths in NMR with the use of composite excitation sequences. Such sequences are shown to be directly constructible from existing composite $\pi/2$ pulses. In addition, a general procedure is given for converting a composite excitation sequence to an equivalent, reduced form that contains fewer rf pulses and simpler rf phase shifts. Experiments are performed on the proton pair of CH_2Cl_2 oriented in a liquid crystal solvent. Applications to quadrupolar spin-1 nuclei and other dynamically simple multilevel systems are discussed.

12125 **Ionization from the sublevels nl with n = 5 and 6 in highly charged ions.** Clark, R.E.H.; Sampson, D.H. (Los Alamos National Lab., NM). *Journal of Physics B: Atomic and Molecular Physics;* **17**: 3311-3320(1984). Contract AC02-76ET53056.

Coulomb Born-exchange calculations of the scaled or reduced cross section for ionization from the 4f and all the 5l and 6l sublevels in hydrogenic ions with Z = infinity are made for eight impact electron energies. The results are fitted to a simple function of energy that is readily integrated over a Maxwellian distribution to obtain collision rates. Using these results in prescriptions given in earlier work that include the lowering of the continua in dense plasmas one can easily obtain approximate values of cross sections and rates for ionization from these sublevels in any highly charged ion with finite Z. 19 references, 3 tables.

12126 **Many-Body theory of electron impact excitation from metastable targets.** Paixao, F.J. da; Csanak, Gy.; Cartwright, D.C. (Universidade Estadual de Campinas, Brazil. Inst. de Fisica; Los Alamos National Lab., NM, USA). pp 178-179 of Physics of electronic and atomic collisions. Abstracts of contributed papers I. Datz, S. Amsterdam, Netherlands; North-Holland (1981). (CONF-810754—Absts.).

From 12. IPEAC international conference on the physics of electronics and atomic collisions; Gatlinburg, TN, USA (15 Jul 1981).

The Martin-Schwinger Many-Body Green's function technique has been used to derive a general S-matrix formula for electron impact excitation from targets in metastable electronic states. This has been achieved by deriving a general equation for the off-diagonal Bethe-Salpeter amplitude.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 12042

12127 **(DOE/ER/03077—267) Computation of the transonic flow about a swept wing in the presence of an engine nacelle.** Ross, D. (New York Univ., NY (USA). Courant Inst. of Mathematical Sciences). Dec 1985. Contract AC02-76ER03077. 190p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86005059.

We have developed a method to model the effects of an engine nacelle on the transonic flow about a swept wing. The nacelle is modelled by adding an inhomogeneous term, which represents a source distribution, to the potential equation, which is solved by relaxation. Our method is an extension of the design code FL22INV of Bauer, Garabedian, and McFadden, which was based on Caughy and Jameson's FLO22 and on the oblique wing code FLO16. In order to obtain a sharply defined obstacle using a source distribution on a finite difference grid, we must use a small grid size near the source. We accomplish this through a mapping of the flow domain to the computational domain. We thus obtain a concentrated source distribution which, for transonic Mach numbers, will cause high speeds and cavitation. To overcome this problem we use a constant coefficient equation for the velocity potential near the source. Once the flow has been computed, the size and position of the nacelle are found by tracing streamlines. We have used our code to study the effect of the presence of an engine nacelle on the shock waves which form above a swept wing in transonic flight. It was found that sizeable shocks appear on wings that were previously nearly shockless. By applying the free boundary redesign technique of FL22INV we were able to minimize the wave drag due to these shocks. The results of these studies are included along with a listing of our new FORTRAN code NACROSS, in which an effort has been made to improve the implementation. 26 refs., 14 figs.

12128 **(DOE/ER/10969—T1) Simultaneous multipoint measurements of density gradients and temperature in a flame. Final report, July 1, 1981-July 31, 1985.** Chang, R.K.; Chu, B.T.; Long, M.B. (Yale Univ., New Haven, CT (USA)). Nov 1985. Contract AC02-81ER10969. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005124.

A summary is given of research directed toward the study of turbulent reacting and nonreacting flows by nonintrusive in situ optical techniques. During the funding period, new diagnostic techniques were developed for the instantaneous mapping of species concentration and temperature in turbulent flames in one or two dimensions. A number of different light scattering mechanisms were utilized including Rayleigh scattering, spontaneous Raman scattering, and coherent anti-Stokes Raman scattering (CARS). Progress was also made on the use of newly-available, high-speed imaging devices which allow the two-dimensional mapping of the flows at rates high enough to follow their temporal evolution. 9 refs., 4 figs.

12129 **(IC—85/22) Transition probabilities in superfluid He4.** Ahmad, M.; Tikoo, S.K. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1985. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700368.

The transition probabilities between various states of superfluid helium-4 are found by using the approximation method of Bogolyubov and making use of his canonical transformations for different states of transitions.

12130 **(IFUSP-P—479) Resolution of hydrodynamical equations for transverse expansions. Part 1.** Hama, Y.; Pottag, F.W. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700355.

The three-dimensional hydrodynamical expansion is treated with a method similar to that of Milekhin, but more explicitly. Although in the final stage one has to appeal to numerical calculation, the partial differential equations governing the transverse expansions are treated without transforming them into ordinary equations with an introduction of averaged quantities. It is only a concern with the formalism and the numerical results that will be given in the next paper.

12131 **(IFUSP-P—481) Resolution of hydrodynamical equations for transverse expansions. Part 2.** Hama, Y.; Pottag, F.W. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700356.

The three-dimensional expansion of an initially flat and hot disc is studied by using the previously developed formalism. As expected, the results show that the 'trivial' region is much more important in the case of transverse flows, unless the total energy M is much larger than the presently available values. As M increases, dN/dxi increases at the same time that its maximum moves outward giving an increasing <xi> which is close to the value estimated by Milekhin.

12132 **(SAND—85-8248) TOPAZ - the transient one-dimensional pipe flow analyzer: equations and numerics.** Winters, W.S. (Sandia National Labs., Livermore, CA (USA)). Dec 1985. Contract AC04-76DR00789. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005063.

TOPAZ is a "user friendly" computer code for modeling the one-dimensional, transient physics of multi-species gas transfer in arbitrary arrangements of pipes, valves, vessels, and flow branches. This report, the third in a series of reports documenting TOPAZ, deals exclusively with governing equations, numerical methods, and code architecture.

12133 **Rayleigh—Taylor stability for a normal shock wave—density discontinuity interaction.** Fraley, G. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **29**: No. 2, 376-386(Feb 1986).

The solution for the perturbation growth of a shock wave striking a density discontinuity at a material interface is developed. The Laplace transformation of the perturbation results in an equation which has a simple solution for weak shock waves. The solution for strong shock waves may be given by a power series. It is assumed that the equation of state is that of an ideal gas. The four independent parameters of the solution are the ratio of specific heat for each material, the density ratio at the interface, and the incoming shock strength. Properties of the solution which are investigated include the asymptotic behavior at large times of the perturbation velocity at the interface, the vorticity near the interface, and the rate of decay of the solution at large distances from the interface. The last is much weaker than the exponential decay in an incompressible fluid. The asymptotic solution near the interface, in addition to a constant term, consists of a number of slowly decaying discrete frequencies. The number is roughly proportional to the logarithm of the density ratio at the surface for strong shocks, and decreases with shock strength. For weak shocks the solution is compared with results for an incompressible fluid. Only interface perturbation velocities which tend to zero at large times lead to a limited deformation of the interface. It is found that these are possible only for density ratios less than about 1.5.

12134 **Vortex method for flows with slight density variations.** Anderson, C.R. (Department of Mathematics and Department of Computer Science, Stanford University, Stanford, California 94305). *Journal of Computational Physics;* **61**: No. 3, 417-444(Dec 1985). Contract AC03-76SF00098.

We present a grid-free numerical method for solving two-dimensional, inviscid, incompressible flow problems with small density variations. The method, an extension of the vortex method, is based on a discretization of the equations written in the vorticity-stream formulation. The method is tested on an exact solution and is found to be both stable and accurate. An application to the motion of a two-dimensional line thermal is also presented.

12135 **Critical behavior of binary liquid mixtures of deuterated and protonated polymers.** Bates, F.S.; Wignall, G.D.; Koehler, W.C. (AT&T Bell Laboratories, Murray Hill, New Jersey 07974). *Physical Review Letters;* **55**: No. 22, 2425-2428(25 Nov 1985).

Binary mixtures of protonated and perdeuterated 1,4-polybutadiene have been examined by small-angle neutron scattering and are shown to exhibit an upper critical solution temperature. The scattering results above the critical temperature are described by the mean-field theory of de Gennes for homogeneous binary polymer mixtures. These results contradict the universally held assumption that mixtures of deuterated and protonated polymers otherwise of identical chemical structure form ideal solutions.

12136 **Spontaneous Raman scattering from shocked water.** Holmes, N.C.; Nellis, W.J.; Graham, W.B.; Walrafen, G.E. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **55**: No. 22, 2433-2436(25 Nov 1985). Contract W-7405-ENG-48.

The OH-Stretch Raman band of liquid water has been observed for the first time at high pressures and temperatures. A new single-pulse spontaneous Raman technique was used to obtain spectra from H_2O shocked up to 26 GPa and 1700 K. Band-shape changes over the range 7.5—26 GPa are fitted well by a two-component mixture model. Intermolecular hydrogen bonding, dominant at 12 GPa, is nearly absent at 26 GPa. The spectra indicate that transport of H^+ and OH^- ions is most probably the mechanism for the electrical conductivity of shocked water.

12137 **Spin-hydrodynamic equations with external disturbances and suitable Green's functions for superfluid ^{3}He-B. New Onsager relations.** Galasiewicz, Z.M. (Univ. of Wroclaw, Poland). *Journal of Low Temperature Physics;* **57**: No. 1/2, 123-150(1984). Contract AC02-76CH00016.

The spin-hydrodynamic equations for superfluid ^{3}He-B are obtained for the case of external, time-dependent fields. On the basis of a microscopic approach, expressions are found for additional terms in equations containing these fields. Considering the linear response of the system to the switching on of external fields, formulas are found for suitable Green's functions (magnetization-magnetization, rotation-rotation, magnetization-rotation , rotation-magnetization). The rotation-rotation Green's function has the $1/q^2$ singularity characteristic of superfluid systems. Connections between Green's functions lead to relations among kinetic coefficients nu, μ_1, and μ_4. It is also shown that there is a conserved quantity Q/ sup (B)/ = div nu/sub s//sup (B)/ that describes sources or magnetic type charges (monopoles) of the superfluid velocity nu/sub s//sup (B)/. Comparison with the phenomenological approach suggests that Q/sup (B)/ is proportional to a pseudoscalar giving the projection of the spin density onto the vector describing that axis of rotation. 14 references.

6450 High Energy Physics

12138 **(AECL—8106) Progress report: Physics Division, January 1-June 30, 1983.** (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1983. 166p. (PR-P—137). NTIS (US Sales Only), PC A08/MF A01. File Number DE86700369.

Nuclear physics studies carried out during the first half of 1983 are described. Work continues on the Tandem Accelerator Superconducting Cyclotron facility. Advances in computer facilities and the new 8 π spectrometer are reported. Crystal structure studies via neutron scattering are also outlined.

12139 **(LPC—84-19) High energy physics in our society.** Crozon, M. (College de France, 75 - Paris. Lab. de Physique Corpusculaire). Sep 1984. 20p. (CONF-8409286—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750314.

From 20. international school of elementary particle physics; Dubrovnik, Yugoslavia (16 Sep 1984).

General survey of interactions between elementary particle physics and our society. The problem is studied for different aspects of our society: men and education, economics, technics, politics, international affairs, honours, myths.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 11843, 11844, 11925, 12276, 12282, 12295

12140 **(BNL—37234) Partial wave analysis of KKPI system in D and E/IOTA region.** Chung, S.U.; Fernow, R.; Kirk, H.; Protopopescu, S.D.; Weygand, D.P.; Boehnlein, D.; Goldman, J.H.; Hagopian, V.; Reeves, D.; Crittenden, R. (Brookhaven National Lab., Upton, NY (USA); Florida State Univ., Tallahassee (USA); Indiana Univ., Bloomington (USA); Southeastern Massachusetts Univ., North Dartmouth (USA)). 1985. Contract AC02-76CH00016;AC02-84ER40125;AS05-76ER03509. 10p. (CONF-850869—14). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005052.

From Meeting of the Particles and Fields Division of the American Physical Society; Eugene, OR, USA (12 Aug 1985).

A partial wave analysis and a Dalitz plot analysis of high-statistics data from reaction $\pi^- p \rightarrow K^+ K/\text{sub } S/\pi^- n$ at 8.0 GeV/c show that the D(1285) is a J/sup PG/ = 1^{++} state and the E(1420) a J/sup PG/ = 0^{-+} state both with a substantial $\delta\pi$ decay mode. The 1^{++} K*anti K wave exhibits a rapid rise near threshold but no evidence of a resonance in the E region. The assignment of J/sup PG/ = O^{-+} to the E is confirmed from a Dalitz-plot analysis of the reaction $pp \rightarrow K^+ K/\text{sub } S/\pi^- X^0$. 11 refs., 5 figs.

12141 **(BNL—37294) Same-sign dilepton production by neutrinos.** Murtagh, M.J. (Brookhaven National Lab., Upton, NY (USA)). 7 Nov 1985. Contract AC02-76CH00016. 10p. (CONF-850869—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005051.

From Meeting of the Particles and Fields Division of the American Physical Society; Eugene, OR, USA (12 Aug 1985).

There has been considerable experimental work on same-sign dilepton production in neutrino interactions over the past 10 years. However, the situation is still unclear. Most experiments do have evidence for an excess of candidates but there is a lack of independent statistically significant results. Present experiments at the Tevatron may provide important new information. However the recent revision of older results and the lower rates from recent experiments indicate that real progress will be difficult. Furthermore, the problems encountered with π/K background subtractions argue for a multi-target experiment. Also, given the conflict with present c anti c calculations, a high statistics bubble chamber experiment would be useful to establish the presence/absence of c anti c events at the presently measured production rates. 13 refs., 6 figs., 2 tabs.

12142 **(CEA-CONF—7823) Status and future of the experiment PS 170 (anti pp $\rightarrow e^+ e^-$).** Duclos, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1985. 9p. (CONF-850152—15; DPh-N-S—2251). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750369.

From 3. LEAR workshop; Tignes-Savoie, France (19 Jan 1985).

The LEAR experiment PS170 is designed to detect the e^{+-} pairs from anti p-annihilation. It aims to measure the proton form factors in the time like region and the spectrum of vector mesons in

the mass range: 1-1,6 GeV. Data have been taken at 300, 600 and 1500 MeV/c incident momenta. The analysis of the 300 MeV/c data gave 200 2-body events: anti pp → e^+e^-), clearly separated from the hadronic background. Values of the form factors are extracted near threshold. The next step will be to accumulate sufficient data to measure separately the electric and magnetic components up to 600 MeV/c. The use of an internal target is considered for measurements at high momenta.

12143 **(CERN-EP—85-167) Supersymmetry: experimental signatures at hadron colliders.** Darriulat, P. (European Organization for Nuclear Research, Geneva (Switzerland)). 9 Oct 1985. 80p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86900394.

Comments are made on the search for supersymmetry using hadron colliders, with the intent of bringing a number of experimental aspects, specific to hadron colliders, to the attention of an audience largely composed of e^+e^- experts. A few typical processes are used to illustrate the main features. The photino is assumed to be the lightest particle with odd R-parity and scalar quarks (whatever the flavor and handedness of their partners) are assumed nearly degenerate in mass. Gluinos and scalar quarks, gauginos and scalar leptons are discussed. 48 refs., 47 figs. (LEW)

12144 **(CERN-EP—85-192) Flavour tagging of parton jets.** Geist, W.M. (Lawrence Berkeley Lab., CA (USA); European Organization for Nuclear Research, Geneva (Switzerland)). 25 Nov 1985. Contract AC03-76SF00098. 42p. (CONF-850785—6). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004531.

From 3. international conference on physics in collision; Autun, France (3 Jul 1985).

The jets of hadrons detected in high energy reactions come usually from a variety of partons produced by many contributing subprocesses. Since partons have not yet been observed directly, tagging of parton jets is so far the only way to investigate interactions and fragmentation of a given type of partons. Tagging methods and some selected results are presented for lepton induced and hadronic collisions. The relevance is discussed of these techniques to detailed studies of QCD subprocesses, fragmentation schemes for quarks, gluons and diquarks, interactions of partons with nuclear matter and electroweak asymmetries. Based on recent data it is finally argued that diffractive systems are jets of tagged parton systems. 53 refs., 27 figs.

12145 **(DOE/ER/02289—13) High energy experimental physics. Progress report and renewal proposal.** Rosen, J.; Miller, D. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy). 1985. Contract AC02-76ER02289. 174p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86005071.

Technical progress is summarized for activities in these areas: study of charm particle production in hadronic collisions (data analysis); large-aperture multiparticle spectrometer; TEV I debuncher ring profile monitor; beta source monochromatizer; final reduction of data from pp and p anti p elastic scattering; high energy elastic scattering and cross section review; consequences of the Auberson-Kinoshita-Martin theorem for the nuclear slope parameter; planning and final design of the elastic scattering and total cross section experiment at the Tevatron Collider; a D-zero pp project and photoproduction experiment; lepton production in heavy-ion collisions; prompt gamma and massive lepton-pair production apparatus; and spin physics with the Fermilab polarized beam facility. (LEW)

12146 **(DOE/ER/02504—423, pp 19-28) JADE: search for new particles and tests of Standard Model.** Glasser, R.G.; Sechi-Zorn, B.; Skard, J.A.J.; Wagner, S.; Zorn, G.T. Oct 1984. NTIS, PC A06/MF A01. File Number DE85008093.

In High energy accelerator and colliding beam user group. Progress report, March 1, 1984-February 28, 1985.

JADE and the other PETRA experiments have recently completed a scan to the highest available e^+e^- center-of-mass energies (46.8 GeV) as part of the search for toponium. There was no evidence for production of a standard charged 2/3 top quark, and an upper limit was derived for the leptonic width times hadronic branching ratio of such a resonance (Γ/sub ee/B/sub h/ < 1.9 keV at the 95% C.L.). Mass limits were also derived for the production of composite scalar bosons. Other important results from the JADE collaboration include a new (preliminary) measurement of the B lifetime (tau/sub B/ = 1.8 +/- 0.5 +/- 0.3 psec), and measurements of the b and c quark electroweak charge asymmetry. Finally, a measurement has been made of the two photon radiative width of the eta meson using the JADE detector operating at PETRA. The reaction studied was $e^+e^- \rightarrow e^+e^-$ eta (eta → γγ). For an e^+e^- luminosity of 14.65 pb^{-1}, the event sample of eta's after background subtraction was 220.8 +/- 14.8 +/- 16.8 events.

12147 **(DOE/ER/02504—423, pp 5-18) PLUTO collaboration: e^+e^- interactions at PETRA.** Chang, C.Y.; Glasser, R.G.; Kellogg, R.G.; Maxfield, S.J.; Sechi-Zorn, B.; Skard, J.A.J.; Skuja, A.; Tylka, A.J.; Welch, G.E.; Zorn, G.T. Oct 1984. NTIS, PC A06/MF A01. File Number DE85008093.

In High energy accelerator and colliding beam user group. Progress report, March 1, 1984-February 28, 1985.

The University of Maryland HEP Group has been involved with the PLUTO collaboration investigating e^+e^- interactions at PETRA since 1977. For the final data taking period the PLUTO detector was modified to include small angle spectrometers to make it sensitive to particles produced at small angles in γγ interactions. Data was taken in this configuration from September of 1981 to July of 1982. The integrated luminosity for this period was about the integral of Ldt = 50 pb^{-1}. That was the last data taking period for PLUTO and many of the collaborators have joined other PETRA experiments. Data analysis has continued since that time, culminating in many publications in 1984, especially in the area of two photon interactions via the process $e^+e^- \rightarrow e^+e^- + \gamma\gamma \rightarrow X$, where X can consist of hadrons or leptons. The major data analysis effort of the collaboration was spent in understanding the interaction γγ → hadrons. The work was carried out from these different points of view: total cross sections as a function of the center of mass energy of the γγ system, the photon structure function as a function of Q^2 and the Bjorken scaling variable X, and the topological properties of final state hadrons, especially as to whether high transverse momenta particle jets can be observed.

12148 **(DOE/ER/02504—423, pp 59-62) Deep inelastic muon scattering at Fermilab - status report.** Steinberg, P.; Skuja, A.; Talaga, R.; Kunori, S.; Snow, G.A.; Aid, S.; Ramberg, E. (Univ. of Maryland, College Park). Oct 1984. NTIS, PC A06/MF A01. File Number DE85008093.

In High energy accelerator and colliding beam user group. Progress report, March 1, 1984-February 28, 1985.

The deep inelastic muon scattering experiment, E-665, is scheduled to start taking data at FERMILAB in April 1986. It is a goal of the laboratory to have a short run a year earlier to tune the new muon beam and to test the equipment of the experiment. This is deemed essential to assure that the experiment is ready for data taking in 1986. The schedule for construction and purchasing is therefore set up to have the equipment ready in March 1985. In the experiment muons of energies up to 800 GeV will scatter from hydrogen and heavier nuclear targets. The experiment is designed to study hadron production and also measure nucleon structure functions well beyond the presently explored region of Q^2. The study of hadronic jets in experiments of this type is complementary to their study in e^+e^- annihilation experiments in that the direction of the virtual photon is precisely determined. One can also study the fragmentation of the residual di-quark. A brief description of the multigamma detector to be used is given and the results of preliminary tests are reported.

12149 **(DOE/ER/02504—423, pp 28-30) Experiment to measure nuclear double - β decay.** Kellogg, R.; Schmitt, M.; Skuja, A. (Univ. of Maryland, College Park). Oct 1984. NTIS, PC A06/MF A01. File Number DE85008093.

In High energy accelerator and colliding beam user group. Progress report, March 1, 1984-February 28, 1985.

The authors have been studying the feasibility of an experiment to observe the double-β decay of Mo^{100}. The intent is to replace a number of the potential wires in the drift chamber built for the PLUTO experiment within Mo strips. The authors would then identify double-β decays as events in which two electrons are emit-

ted simultaneously from a single point in the Mo source. By measuring the degree of curvature of the tracks in an approximately 100 gauss field, the authors would be able to distinguish 0-nu decays from 2-nu decays since the electrons in 0-nu decays would carry the fully 3.05 MeV decay energy. The goal is to measure the 2nu-decay with a lifetime of 10^{23} years. Assuming the neutrino to be totally Majorana and that right-handed currents do not exist, this lifetime would correspond to a neutrino mass of 2.5 eV, a result of great potential interest for particle physics and cosmology.

12150 (DOE/ER/02504—423, pp 63-64) **Elastic nu/sub e/ e scattering at LAMPF.** Krakhauer, D.A.; Talaga, R.L. Oct 1984. NTIS, PC A06/MF A01. File Number DE85008093.

In High energy accelerator and colliding beam user group. Progress report, March 1, 1984-February 28, 1985.

The neutrino experiment, located at the LAMPF beam stop, began taking data in September 1983 and continued until the LAMPF shutdown in February 1984. This was the first fully-equipped run of the neutrino experiment. A preliminary analysis of the data for neutrino-electron elastic scattering and for the anomalous production of the anti-nu e has been completed. The elastic scattering signal has a significant background from accelerator-produced neutrons and therefore more severe restrictions on elastically scattered candidates have been imposed. The total cross section was found to be $\sigma(\text{nu/sub e/e}^- \rightarrow \text{nu/sub e/e}) = (10.6 \pm 4.6 \pm 1.9) \times \text{E/sub nu/} \times 10^{-43}$ cm^2, where E/sub nu/ is in units of GeV. The first uncertainty is statistical, and the second is systematic. The authors also set a limit on the multiplicative lepton number conservation law $< 2.2\%$ at 90% confidence limit. The neutrino oscillation mode anti-nu/sub μ/ $\rightarrow$ anti-nu/sub e/ is not observed and limits are placed on Δm^2 (if $\sin^2 2\theta$/sub m/ = 1) and on $\sin^2 2\theta$/sub m/ (if Δm^2 is large). The limits are: $\Delta m^2 < 0.61$ eV^2 and $\sin^2 2\theta$/sub m/ < 0.044 respectively, and both at the 90% confidence level.

12151 (DOE/ER/02504—423, pp 54-58) **Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c.** Yodh, G.B.; Glasser, R.G.; Goodman, J.A.; Gupta, S.; Ellsworth, R.W. (Univ. of Maryland, College Park). Oct 1984. NTIS, PC A06/MF A01. File Number DE85008093.

In High energy accelerator and colliding beam user group. Progress report, March 1, 1984-February 28, 1985.

During the last year this experiment had its first run with 800 GeV/c protons from TeV II. A total of 700 hours of beam time was delivered; the authors took 380 hours for set up and calibrations and 320 hours were used for data taking. The upgraded multi-particle-spectrometer (MPS) has several improvements and additions. A large number of triggers were obtained for various targets with high E/sub T/ and interacting beam (IB) triggers and for dimuon studies. A preliminary look at the jet data during the run showed that at 800 GeV/c the trigger was working well. This was deduced from the study of the E/sub t/ dependence of the trigger rate for Global and reduced global triggers. The on-line planarity studies showed the expected variation with E/sub t/. The sum of all the signals from the large angle, the insert, the forward and the beam calorimeters showed a clean peak at the total energy of 800 GeV with a width of about 10 percent. The total luminosity obtained for high E/sub t/ and jet studies was about 30 nb^{-1} as compared to 5 nb^{-1} for the 1981 run. The dimuon sector of the experiment has been analyzed by the Indiana group. They were able to reconstruct di-muon masses from 2 to 5 GeV. A clear psi/J peak was observed in $\mu^+\mu^-$ events from events produced with H, C, and Cu targets, albeit with small statistics. No such psi/sub J/ signal was observed for the $\mu^-\mu^-$ and $\mu^+\mu^+$ combinations. The mass distributions were fitted with a formula.

12152 (DOE/ER/02504—423, pp 65) **Parity violation in p-p and p-nucleus scattering at LAMPF.** Talaga, R.L. Oct 1984. NTIS, PC A06/MF A01. File Number DE85008093.

In High energy accelerator and colliding beam user group. Progress report, March 1, 1984-February 28, 1985.

The authors had two major runs of this experiment in the past year: one in October 1983 with a 17 liter liquid hydrogen target, another in June 1984 with liquid deuterium in the target vessel. Both runs were successful and the authors anticipate an accuracy of 2×10^{-7} in the asymmetry parameter for anti p-p and anti p-d scattering at 800 MeV. The final analysis of both experiments is expected to be completed before January 1985. The experimental apparatus has been disassembled and the authors do not intend to repeat this experiment in the future.

12153 (DOE/ER/02504—423, pp 66-68) **D/sub phi/ experiment at TeV I.** Kunori, S.; Rapp, P. (Univ. of Maryland, College Park). Oct 1984. NTIS, PC A06/MF A01. File Number DE85008093.

In High energy accelerator and colliding beam user group. Progress report, March 1, 1984-February 28, 1985.

In the past year the Dphi experiment advanced a major step forward with its inclusion in the Fermilab budget. Aroused interest in the physics community has been marked by the initiation of two new major groups into the Dphi collaboration. In particular, an LBL group has joined in support of the muon detector subgroup to which Maryland also belongs. The LBL group has made a strong presentation for a modified design of the muon chamber layout, and the alternatives are now under study. The Maryland Dphi collaborators (S. Kunori and P. Rapp) participated effectively in the FNAL tests of a prototype muon detector in the NW test beam in early 1984. The test beam data were analyzed in record time with intensive participation by S. Kunori, and the results were reported to the Dphi Technical Review Committee at FNAL on June 8. Data were taken at beam energies from 10-150 GeV. The current status of the muon trigger was presented to the Michigan State Dphi Workshop by P. Rapp on August 9. One unknown is the vertex resolution available a few μsec after bunch crossing.

12154 (DOE/ER/03072—28) **[Review of experiments measuring CP nonconservation].** Gollin, G.D. (Princeton Univ., NJ (USA). Joseph Henry Labs.). Aug 1985. Contract AC02-76ER03072. 8p. (CONF-850869—11). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004410.

From Meeting of the Particles and Fields Division of the American Physical Society; Eugene, OR, USA (12 Aug 1985).

Recent experiments setting limits on the magnitude of the ratio of two CP nonconservation parameters ϵ'/ϵ are discussed. Gauge theory calculations suggest that $\epsilon'/\epsilon > .005$, somewhat at odds with the results $\epsilon'/\epsilon = -.0046 \pm .0058$ from a Chicago-Saclay measurement and $\epsilon'/\epsilon = .0017 \pm .0082$ from a Yale-BNL experiment. 9 refs., 5 figs., 2 tabs.

12155 **(FNAL-TM—1368) Operational approach to high energy physics detectors at Fermilab.** Bodnarczuk, M. (Fermi National Accelerator Lab., Batavia, IL (USA)). 1985. Contract AC02-76CH03000. 99p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86004695.

Some of the basic concepts used in high energy physics experiments at Fermilab are described, including the interaction forces, hadrons and leptons, baryons and mesons, quark model dynamics, internal structure, strange, charm, bottom and top particles, and accelerators. Two experiments dealing with charm production are taken as examples in order to explain the anatomy of high energy physics detectors. 9 refs., 9 figs. (LEW)

12156 **(IPNO-TH—83-19) Antinucleon nucleon annihilations into two mesons.** Moussallam, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jan 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86750316.

We study two aspects of the antinucleon-nucleon annihilation into two mesons (antiNN $\rightarrow M_1M_2$), starting from simple Born diagrams. On one hand, we discuss the possibility of modelling the antiNN optical potential with the box diagrams related to the M_1M_2 channels. We include the lightest pseudoscalar, scalar and vector mesons with effective coupling constants. Much more channels appear to be needed in order to achieve sensible results. On the other hand, we show that a simple phenomenological optical potential, successful in reproducing antiNN elastic scattering and total annihilation data can be further used to make predictions on the antiNN $\rightarrow M_1M_2$ processes, which prove to be in good agreement with experiment. We find a lower bound of 17% on the relative

contribution of these reactions to the antiNN annihilation. Also, the model favours a rather small effective radius for the nucleon.

12157 **(IPNO-TH—84-65) Spin dependent NN and N anti N interaction from the Paris potential.** Loiseau, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 14p. (CONF-8409162—18). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750315.

From 6. international symposium on high energy spin physics; Marseille, France (12 Sep 1984).

In this talk we would like to illustrate what is understood in low and medium energy NN and N anti N interactions - their spin dependence in particular - in terms of meson exchanges and eventually πN resonances through the example of the Paris potential.

12158 **(IPNO-TH—84-66) Static baryon-baryon potential in the Skyrme model.** Vinh Mau, R.; Lacombe, M.; Loiseau, B.; Cottingham, W.N.; Liboa, P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86750319.

Methods for deriving a static baryon-baryon (nucleon-nucleon as well as nucleon-delta and transition) potential from the Skyrme model are briefly reported. Some results obtained with these methods are also presented and discussed.

12159 **(ISN—84-31) Recent results from the Bugey neutrino oscillation experiment.** Koang, D.H. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 1984. 6p. (CONF-8405193—49). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750333.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

The energy spectrum of electron antineutrinos has been measured at two distances, 13.6 and 18.3 meters, from the core of a PWR power reactor at Bugey (France). About 63000 antineutrinos events have been recorded using the inverse β-decay reaction antive + p $\rightarrow$ n + e$^+$. A significant difference in the counting rate between the two positions has been observed. The compatibility of the results with solutions in a two-neutrino oscillation analysis is discussed.

12160 **(ISN—84-32) Indication of neutrino oscillation from the Bugey experiment.** Koang, D.H. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 1984. 7p. (CONF-8406182—8). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750334.

From 11. international conference on neutrino physics and astrophysics; Nordkirchen bei Dortmund, F.R. Germany (11 Jun 1984).

The energy spectrum of electron antineutrinos has been measured at two distances, 13.6 and 18.3 meters, from the core of a PWR power reactor at Bugey (France). About 63000 antineutrinos events have been recorded using the inverse β-decay reaction antive + p $\rightarrow$ n + e$^+$. A significant difference in the counting rate between the two positions has been observed. The compatibility of the results with solutions in a two-neutrino oscillation analysis is discussed.

12161 **(JINR—R-1-84-800) Correlations of emission frequency of π0 mesons and proton produced in collisions of protons and π^0 mesons with xenon nuclei within the 2-9 GeV energy range and a problem of slow π^0 meson absorption in a target nucleus.** Mulas, Eh.; Slovinskij, B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700408.

Submitted to the journal Sov. J. Nucl. Phys. .

Distributions in the number n_0 of π^0 mesons emitted in collisions of protons at 2.3 GeV/c and π^- mesons at 9 CeV/c with xenon nuclei has been obtained. Correlations between π-meson multiplicity and protons accompanying them are studied. Dependence of the average multiplicity $<n_0>$ on the number on protons emitted in the forward and backward directions (in l.s) is analysed. Experimental data on the multiplicity of π^0 mesons produced in π^-Xe quasi-free collisions are compared with the Poisson distribution and with results of calculations according to the isospin model. No correlations between the number of π^0 and π^+ mesons at different multiplicities of protons emitted has been observed. The obtained data indicate that πI meson absorption inside a target nucleus may occur.

12162 **(LA-UR—85-4009) Determination of the neutron lifetime using e-p coincidence.** Wilkerson, J.F. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-8511137—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86003670.

From Workshop on the investigation of fundamental interactions with cold neutrons; Gaithersburg, MD, USA (14 Nov 1985).

The neutron lifetime is a critical parameter both in electroweak theory and in astrophysical calculations. Unfortunately, present measurements of the free neutron lifetime, all of similar accuracy, disagree. The resulting value for the lifetime is one of the least accurately determined fundamental nuclear constants. We are currently constructing an experiment to measure the neutron lifetime to better than 1% accuracy. The measurement will employ a novel experimental technique, a calorimetric measurement of the neutron flux. We are also employing a sophisticated detector system which should yield good signal to background discrimination. A summary of the experiment design will be presented. 10 refs., 3 figs.

12163 **(SLAC—289) Study of hadronization using energy flow from e$^+$e$^-$ annihilation into quarks and gluons at $\sqrt{s}$ of 29 GeV.** Rosenberg, L.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1985. Contract AC03-76SF00515. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86004700.

We have made a high statistics study of QCD jets produced in e$^+$e$^-$ annihilations at $\sqrt{s}$ of 29 GeV and observed in the MAC detector located at the PEP storage ring at SLAC. The MAC detector uses calorimetry and provides a homogeneous response over much of its 98% . 4π sr instrumented solid angle. A data sample of well reconstructed hadronic events was selected by requiring that E/sub vis/ in the calorimeters be near $\sqrt{s}$, and almost all the energy be deposited in the central calorimeters. Fits of the jet transverse energy flow are made to the data using String (STR) model and several types of Independent Jet (IJM) model hypotheses, where α/sub s/, the strong coupling constant, and σ/sub q/, the width of the secondary quark P/sub perpendicular/ distribution, are free parameters. The fits to O(α/sub s/^{2} using MS-bar renormalization yield α/sub s/ $\sim$0.17 with the STR hypothesis, and α/sub s/ $\sim$0.12 with the various IJM hypotheses. The correlations between α/sub s/ and σ/sub q/ are examined. Detailed comparisons were made with other experimental results. The energy flow projected onto the event plane of 3-jet events selected from the above data sample was studied. The data shows an asymmetric energy flow around the thin jet. Such an asymmetry was predicted by the STR model, and a cluster model (Webber) incorporating soft gluon interference. The various IJM models show no such asymmetry. We associate this asymmetry with coherence effects during hadronization. 106 refs., 58 figs., 18 tabs.

12164 **(TRI-PP—85-72) Recent achievements in meson sciences at TRIUMF.** Vogt, E. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Aug 1985. 10p. (CONF-8508120—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900366.

From Kyoto international symposium: the jubilee of the meson theory; Kyoto, Japan (15 Aug 1985).

A selection of recent TRIUMF experiments is briefly discussed to illustrate how meson science as a whole is flourishing at the meson factories. A brief description is given of the TRIUMF cyclotron and its experimental facilities as a basis for the discussion of the science. Also described is the TRIUMF applied program, including pion therapy, accelerator production of isotopes, and a Positron-Emission Tomograph. 22 refs., 11 figs. (LEW)

12165 Study of inclusive K/sub S/°, Λ, and Lambda-bar production in diffractive γp interactions. Bhadra, S.; Appel, J.A.; Bartlett, D.F.; Denby, B.H.; Biel, J.; Bintinger, D.; Bharadwaj, V.K.; Blodgett, D.E.; Bracker, S.B.; Bronstein, J. (University of Colorado, Boulder, Colorado, 80309; University of California at Santa Barbara, Santa Barbara, California 93106; Carleton University, Ottawa K1S 5B6, Canada; Fermi National Accelerator Laboratory, Batavia, Illinois, 60510; National Research Council of Canada, Ottawa, Ontario K1A 0R6, Canada;). *Physical Review Letters;* **55**: No. 25, 2749-2751(16 Dec 1985).

We have studied inclusive K/sub S/, Λ, and Lambda-bar photoproduction over the ranges 40<E/sub γ/<170 GeV and forward produced mass 2<M/sub F/<10 GeV. We observe equal Λ and Lambda-bar production rates and spectra as expected in a diffractive process where the target proton remains unaltered. We show that the fraction of hadronic events with a strange particle produced in events with forward mass M/sub F/ agrees well with the same measurement in e^+e^- annihilation at a center-of-mass energy E/sub c.m./ = M/sub F/. The X = 2P/M/sub F/ distributions of these three particles in the forward-mass rest frame are compared with theoretical predictions.

12166 Limits on like-sign dilepton production in ν/sub μ/ interactions. Baltay, C.; Bregman, M.; Hibbs, M.; Liu, J.T.; Okamitsu, J.; Schaffer, A.C.; Shastri, K.; Baker, N.J.; Connolly, P.L.; Kahn, S.A. (Columbia University, New York, New York 10027). *Physical Review Letters;* **55**: No. 23, 2543-2546(2 Dec 1985). Contract AC02-76CH00016.

We have searched for the production of like-sign dilepton events (ν/sub μ/+Ne→μ^- +e^- +. . .) in a wide-band neutrino beam at Fermilab using the 15-ft bubble chamber. We observe no signal above the background arising from conventional sources. We set 90%-confidence-level upper limits for the production rates of (ν/sub μ/+Ne→μ^- +e^- +. . .)/(ν/sub μ/+Ne→μ^- +. . .)< or =0.76 x 10^{-4} and (ν/sub μ/+Ne→μ^- +e^- +. . .)/(ν/sub μ/ +Ne→μ^- +e^+ +. . .)< or =5.3 x 10^{-3}. .AE

12167 Search for quark deconfinement: Strangeness production in pp, dd, pα, and αα collisions at √s/sub N/N = 31.5 and 44 GeV. Kesson, T.; Albrow, M.G.; Almehed, S.; Benary, O.; Boggild, H.; Botner, O.; Breuker, H.; Brody, H.; Burkert, V.; Callen, B. (Brookhaven National Laboratory, Upton, New York 11973; Cambridge University, Cambridge CB3 9EW, United Kingdom; CERN, CH-1211 Geneve 23, Switzerland; Niels Bohr Institute, University of Copenhagen, DK-2100). *Physical Review Letters;* **55**: No. 23, 2535-2538(2 Dec 1985).

Relative yields of phi and charged K mesons are measured as functions of charged multiplicity in the central rapidity region for pp, dd, pα, and αα collisions at √s/sub N/N = 31.5 and 44 GeV. No anomalous strange-particle production is observed in αα reactions relative to pp even at large multiplicities corresponding to events comprising less than 3.6 x 10^{-4} of the inclusive cross section.

12168 First observation and cross-section measurement of ν/sub e/+e^-→ν/sub e/+e^-. Allen, R.C.; Bharadwaj, V.; Brooks, G.A.; Chen, H.H.; Doe, P.J.; Hausammann, R.; Lee, W.P.; Mahler, H.J.; Potter, M.E.; Rushton, A.M. (University of California, Irvine, California 92717). *Physical Review Letters;* **55**: No. 22, 2401-2404(25 Nov 1985).

We report the first observation and cross-section measurement of ν/sub e/+e^-→ν/sub e/+e^-. Using neutrinos of energy less than 53 MeV, we observed 63 +- 17 events consistent with ν+e^-→ν+e^-, of which 51 +- 17 events are assigned to ν/sub e/ +e^-→ν/sub e/+e^-. The resulting cross section, {[8.9 +- 3.2(statistical) +- 1.5(systematic)] x 10^{-45} cm^2/MeV}E/sub ν/, agrees with standard electroweak theory, rules out constructive interference between weak charged-current and neutral-current interactions, and begins to indicate the existence of interference between these two interactions.

12169 Progress report on recent rare muon decay experiments at the Los Alamos meson physics facility. Hogan, G.E.; Bolton, R.D.; Bowman, J.D.; Carlini, R.; Cooper, M.D.; Duong-Van, M.; Frank, J.S.; Hallin, A.L.; Heusi, P.; Hoffman, C.M. (Los Alamos Scientific Lab., NM; Stanford Univ., CA; Chicago Univ., IL; Temple Univ., Philadelphia, PA). *Nuclear Physics [Section] A;* **434**: vp(25 Feb 1985). (CONF-840789—).

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

A search has been performed for the decays μ -> eee, μ -> eγ, and μ -> eγγ with a sensitivity in the branching ratios at the level of 10^{10}. The experiment used a separated, 26 MeV/c μ^+ beam with an average intensity of 300 kHz. A total of 2.2 x 10^{11} muon decays were examined for the present result. The detector for the experiment is the Crystal Box, which consists of a cylindrical drift chamber surrounded by 396 NaI(Tl) crystals. A layer of scintillation counters in front of the crystals provided timing for electrons and a veto for photons. The energy resolution for electrons and photons is proportional6% (FWHM). The position resolution of the drift chamber is 350 μm leading to a vertex cut with a rejection of 10^3 for μ -> eee. The timing resolution is proportional300 ps from the scintillators and proportional1 ns from the crystals. No candidate for μ -> eee has been found, yielding an upper limit for the branching ratio of Bsub(μ3e) < 1.3 x 10^{10} (90% C.L.). (orig.).

12170 Hard quark-quark scattering with exclusive reactions. Barton, D.S.; Bunce, G.M.; Carroll, A.S. (Brookhaven National Lab., Upton, NY). *Journal de Physique (Paris), Colloque;* **46**: 115-120(Feb 1985). (CONF-8409162—).

From 6. international symposium on high energy spin physics; Marseille, France (12 Sep 1984).

Data from $\pi^- p \rightarrow$ elastic and $rho^- p$ final states for scattering at 90° center of mass, $-t = 9\ GeV^2/c^2$ are presented. A large $rho^- p$ signal is seen and the rho^- are strongly polarized. This polarization tests a QCD prediction that quarks cannot flip helicity. The test fails dramatically. 8 references.

12171 Polarization observables Dsub(NN), P and A for p(pol)p → p(pol)π^+n at 800 MeV. Bonner, B.E.; McNaughton, M.W.; van Dyck, O.B. (Los Alamos National Lab., NM, USA). pp 183-184 of Few body problems in physics. Volume II, contributed papers. Zeitnitz, B. Amsterdam, Netherlands; North-Holland (1984). (CONF-830862—Vol.2).

From 10. international conference on few-body problems in physics; Karlsruhe, F.R. Germany (21 Aug 1983).

In conjunction with a vector polarization transfer measurement in the p(pol)p → d(pol)π^+ reaction, the authors obtained data on polarization observables for p(pol)p → p(pol)π^+n at 800 MeV incident proton energy. Scattered protons were detected in a spectrometer at angles from 5° to 11°.

12172 Radiochemical solar neutrino experiment using ^{81}Br(nu, e^-)^{81}Kr. Hurst, G.S.; Chen, C.H.; Kramer, S.D.; Payne, M.G.; Willis, R.D. (Oak Ridge National Lab., TN). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 96-104(1983). (CONF-820989—). Contract W-7405-ENG-26.

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

Both geochemical and radiochemical experiments based on the interaction ^{81}Br(nu,e^-)^{81}Kr to detect ^{7}Be solar neutrinos have been suggested as a logical extension of the ^{37}Cl experiment of Davis et al. The ^{81}Br experiment, however, requires the development of a direct counter for the slowly decaying ^{81}Kr. Progress toward such a detector based on Resonance Ionization Spectroscopy (RIS) is discussed.

12173 Physics with underground leptons of atmospheric origin. Gaisser, T.K. (Univ. of Delaware, Newark). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 203-213(1983). (CONF-820989—). Contract AC02-78ER05007.

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

Muons of great energy and neutrinos of all energies produced in the atmosphere by cosmic rays can penetrate to deep underground detectors. With existing and proposed proton decay detectors in mind, we review the physics accessible to underground cosmic ray experiments. Primary emphasis is on use of multiple coincident muons to study composition of primary cosmic rays at energies inaccessible to direct experiment.

12174 **Beyond proton decay: other physics possibilities with the Homestake nucleon decay detector.** Cherry, M.L.; Davidson, I.; Lande, K.; Lee, C.K.; Marshall, E.; Steinberg, R.I. (Univ. of Pennsylvania, Philadelphia). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 248-264(1983). (CONF-820989—).

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

The Homestake Gold Mine presently houses the Brookhaven solar neutrino experiment and a 300-ton water Cherenkov detector at a depth of 4200 meters water equivalent. The Cherenkov detector has been used to study nucleon decay, multiple muons, and neutrino bursts. An array of liquid scintillator, with surface area of 130 m^2, is presently being constructed to measure magnetic monopoles, neutrino oscillations, underground muons, and neutrino bursts. At the same time, a 1 km^2 extensive air shower array is being built on the surface in order to measure the high energy cosmic ray composition with simultaneous surface and underground shower measurements. Future plans call for a 1406-ton liquid scintillator Tracking Spectrometer to measure nucleon decay, n-anti n transitions, and the low energy cosmic ray neutrino spectrum. We describe the present results and the possibilities for physics other than nucleon decay in the nucleon decay detectors.

12175 **Siting, constructing, and maintaining a deep underground science laboratory.** Sharp, R.R. Jr. (Los Alamos National Lab., NM). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 278-284(1983). (CONF-820989—).

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

Experience from a recent site selection study has shown that the important considerations in siting a deep underground science facility are numerous, complicated, and most often based in economics. Even so, there are natural constraints on the maximum depth, size of openings, and construction techniques that can be attained or utilized at any particular site. In general, these are set by the local geothermal gradient, hydrologic regime, and properties of the rock mass or substance that are pertinent to geological, mining, and drilling engineering. At the same time, economics control the type of access, means of dewatering, and methods of sustaining the openings that are most feasible. If major faults can be avoided, sites offering acceptable temperature, a low water table, no outstanding aquifers or badly broken ground above the main openings, and strong, massive, largely impermeable rocks surrounding them at depth are best. Upon completion of a facility, the investment and safety of the occupants demand its rigorous maintenance.

12176 **Underground neutrino astronomy.** Schramm, D.N. (Univ. of Chicago, IL). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 318-323(1983). (CONF-820989—). Contract AC02-80ER10773.

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

A review is made of possible astronomical neutrino sources detectable with underground facilities. Comments are made about solar neutrinos and gravitational collapse neutrinos, and particular emphasis is placed on ultra-high energy astronomical neutrino sources. An appendix mentions the exotic possibility of monopolonium.

12177 **Discussion on a national underground science facility (NUSF).** Fowler, W.A.; Davis, R. Jr.; Gaisser, T.; Mann, A.K.; Rosen, S.P.; Stacey, F.D.; Wenzel, W. (California Institute of Technology, Pasadena). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 434-446(1983). (CONF-820989—).

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

This week has demonstrated the remarkable vitality, exciting promise, and great breadth and range of modern day science. We have heard about plans and prospects in solar, atmospheric and cosmic neutrinos, nucleon decay, cosmic rays, gravity and gravitational waves, and double beta decay. It's indeed an incredible range of proposed activity in science for the future and it is clear, at least to me, that much of that science must be done underground. How much and when and where are decisions to be made in the future. We have done our job this week in bringing to light the exciting possibilities and promise in science underground. Of course, we also learned, in the delightful talk by Bob Sharp on Thursday morning, about plans here at Los Alamos to make that science possible. In this concluding session we will not discuss specific proposals, but rather the requirements placed on underground experimentation by the various areas of science that have been discussed this week. There will be six brief statements by the gentlemen surrounding me, followed in each case by two or three questions or comments from the audience.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 12224, 12226, 12246, 12262, 12263, 12282, 12295, 12357, 12357

12178 **(CBPF-NF—001/84) Glueballs in πp p → phi phi n.** Caruso, F.; Escobar, C.O.; Santoro, A.F.S.; Souza, M.H.G. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700382.

A model which is able to explain the main features of the experimental data for the reaction $\pi^- p \rightarrow$ phi phi n, is proposed, starting from the assumption that two glueball resonances with J sup(PC) = 2^{++} are produced in this reaction. The coupling of these glueball candidates to phi phi is estimated, and come out to be of the same strength as ordinary hadronic couplings.

12179 **(CBPF-NF—009/84) Possible interaction between spin-1/2 and spin-3/2 fields.** Fleury, N.; Lopes, J.L. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700370.

A straighforward extension of the standard Weinberg-Salam model to Rarita-Schwinger formalism, is a heuristic way to obtain electroweak currents for spin-3/2 leptons. A new interaction between spin-1/2 and spin-3/2 particles that maintains the SU(2) x U(1) gauge invariance is postulated and a possible form for the interaction involving these two types of particles and the gauge fields is obtained. This takes place through a coupling which involves derivatives of the electromagnetic field and the corresponding coupling constant is inversely proportional to the mass of spin-3/2 particles. Several reactions are possible with this new interaction such as the radiative decay of a charged Rarita-Schwinger particle. Other reactions are corrections to well-known processes: for instance, in the usual Compton effect, the fermionic virtual line can be replaced by the corresponding spin-3/2 one. But, due to the large mass of the spin-3/2 lepton, these corrections are significantly non negligible only at ultra relativistic energies. On the other hand, in the low energy limit this correction gives fortunately no contribution to the Thomson cross section because the coupling 3/2 - 1/2 - γ is proportional to the photon's momentum. If it is considered all the possible couplings of these fields, one can combine them in diagrams of lowest orders whose theoretical predictions have to be submitted to experimental pressure.

12180 **(CBPF-NF—034/84) Vector meson and axial-vector diquark decay constants.** Bediaga, I.; Predazzi, E.; Santoro, A.F.S.; Souza, M.H.G.; Tiomno, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700371.

A natural generalization to the case of unequal constituent masses of the formula which gives the correct decay constants for vector mesons of the quarkonium type is proposed. Within the phi-

losophy where diquarks are used as baryonic constituents, this allows us to evaluate the decay widths for all vector particles both mesons and diquarks to be used later on the calculate the baryon lifetimes.

12181 **(CBPF-NF—035/84) Lambda^{+} sub(c) lifetime in a quark-diquark scheme.** Bediaga, I.; Predazzi, E.; Santoro, A.F.S.; Souza, M.H.G.; Tiomno, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700383.

The lambda^{+} sub(c) lifetime is calculated in a quark-diquark philosophy using previous results and a number of 'natural' assumptions. It is shown that the contribution from W-exchange dominates in this case that from W-radiation which is estimated of the order of approx. 20%. The result is in good agreement with the experimental findings.

12182 **(CERN-EP—85-159) Ideas on the pomeron-proton interaction at the parton level.** Ingelman, G. (European Organization for Nuclear Research, Geneva (Switzerland); California Univ., Los Angeles (USA)). 3 Oct 1985. 9p. (CONF-8506197—4). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900390.

From Workshop on elastic and diffractive scattering at the collider; Chateau de Blois, France (3 Jun 1985).

The idea of an underlying partonic process in diffractive scattering is examined. Some possible models for such interaction mechanisms are discussed together with their experimental consequences regarding the structure of the diffractively excited hadronic system. 20 refs., 6 figs.

12183 **(IC—85/8) Anomalous electroweak baryon number non-conservation in the early universe.** Kuzmin, V.A.; Rubakov, V.A.; Shaposhnikov, M.E. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700372.

We estimate the rate of the anomalous electroweak baryon-number non-conserving processes in the cosmic plasma and find that it exceeds the expansion rate of the universe at T> (a few).10^{2} GeV. We study whether these processes wash out the Baryon Asymmetry of the Universe (BAU) generated at some earlier state (say, at GUT temperatures). We also discuss the possibility of the BAU generation by the electroweak processes themselves and find that this does not take place if the electroweak phase transition is of the second order. No definite conclusion is made for the strongly first-order phase transition. We point out that the BAU might be attributed to the anomalous decays of heavy (Msub(F)> or approx. Msub(W)/αsub(W)) fermions if these decays are unsuppressed.

12184 **(IFUSP-P—455) Asymptotic behavior of quark masses induced by instantons.** Carneiro, C.E.I.; Frenkel, J. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Feb 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700401.

A simple argument which shows that the dynamical mass induced by interactions of massless quarks with pseudo-particle configurations behaves like p^{-6} for asymptotically large quark momenta is presented.

12185 **(IFUSP-P—475) Anomalous Z^{0} decay and a stronger coupled Higgs boson.** Novaes, S.F.; Pleitez, V. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 14p. (IFT-P—06/84). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700373.

The possibility that a Higgs boson with a stronger coupling to Z^{0} and a dominant decay in two photons could explain the anomalous Z^{0} decays is investigated.

12186 **(IFUSP-P—476) New weak boson decays and possible spin 3/2 leptons.** Fleury, N.; Lopes, J.L.; Simoes, J.A.M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700374.

The possibility is discussed that new spin 3/2 leptons can occur in nature as a manifestation of a leptonic structure and in multiplets in supersymmetric theories. A new interaction between spin 1/2 and spin 3/2 particles that maintains the standard SU(2) sub(L) x U(1) local gauge invariance is postulated. A comparison with the anomalous $Z^{0} \rightarrow e^{+}e^{-}\gamma$ events is made and new decays for the weak bosons are studied.

12187 **(IFVE-ONF—84-21) Possibility to study electromagnetic properties of neutral pions in experiments with electron-positron colliding beams.** Bel'kov, A.A.; Kuraev, Eh.A.; Pervushin, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700380.

Submitted to the journal Sov. J. Nucl. Phys. .

The possibility of experimental study of the low-energy electromagnetic parameters of neutral pions in electron-positron colliding beams is considered. In the framework of broken chiral symmetry theory the value of the cross sections of reactions $e^{+}e^{-} \rightarrow \pi^{0}\pi^{0}\gamma$, $e^{+}e^{-} \rightarrow e^{+}e^{-}\pi^{0}\pi^{0}$ and $e^{+}e^{-} \rightarrow \pi^{0}\pi^{0}$ are obtained. The calculation results show, that these processes are accessible to study with the existing $e^{+}e^{-}$-beams. These experiments will provide the model-independent information on the amplitude of the Compton effect on neutral pion ($\gamma\gamma \rightarrow \pi^{0}\pi^{0}$) in the physical region of the $\pi\pi$-interaction msub($\pi\pi$)sup(2) > 4msub(γ)sup(2).

12188 **(IFVE-OTF—83-85) Superhigh energy charmed particles penetration in matter.** Gershtejn, S.S.; Kanevskij, B.L.; Likhoded, A.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700404.

A calculation of kinetics of nuclear-electromagnetic shower attenuation with an account for charmed hadrons is given. Charmed hadrons present in a shower at super-high energies change the picture of the nuclear-electromagnetic cascade attenuation. The effect obtained is proportional to the cross section of the charmed particle production.

12189 **(IFVE-OTF—84-62) Sum rules and high-energy asymptotics of pion-pion amplitude for large angles.** Parfenov, Yu.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700386.

Submitted to the jounnal Sov. J. Nucl. Phys. .

Starting from a dispersion relation for the pion scattering amplitude, the sum rule which connects the angular distribution at high energies with the contribution of lower resonances is obtained. For the region of angles 0.5 < cosTHETA < 0.95 the sum rule is shown to be saturated with sufficient precision by three lower resonances. The results are compared with the existing experimental data.

12190 **(IFVE-OTF—84-99) Baryon string model. 1. Canonical formalism and general solution of classical equations of motion for the three-string.** Plyushchaj, M.S.; Pron'ko, G.P.; Razumov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700405.

Submitted to the journal Theor. Math. Phys. .

A general solution to the equations of motion of the three-string is obtained. An explicit form for the parametrization of the initial data of all possible classes of solutions is found. Upper estimates for the classical Regge trajectories of these solutions are obtained.

12191 **(IPNO-TH—83-67) Nucleon-antinucleon resonance spectrum in a potential model.** Lacombe, M.; Loiseau, B.; Moussallam, B.; Vinh Mau, R. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Dec 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86750366.

We investigate the spectrum of antinucleon-nucleon resonances, using an optical potential we derived recently. An effective method to compute the S-matrix poles is presented. The corresponding phase shifts do not behave as ordinary resonances in the Argand diagram. We show, however, that the poles can be located by extrapolating the phase shifts with the aid of polynomial fits. The annihilation part of our potential is state and energy dependent and of short range. It yields a richer spectrum than that given by a longer ranged annihilation model.

12192 **(IPNO-TH—84-46) Relativistic wave equations for two interacting particles and zero mass bound states.** Sazdjian, H. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jun 1984. 83p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86750321.

We construct relativistic wave equations for two interacting particle systems involving spin-o bosons and/or spin-1/2 fermions. The method consists in quantizing the manifestly covariant formalism with constraints of classical relativistic hamiltonian mechanics. In this formalism the two-particle wave function satisfies two independent, but compatible, wave equations, which thus determine in a definite way its relative time evolution. We classify the interaction potentials according to their tensor structure, such as scalar, pseudoscalar, vector. We apply these results to the construction of confining systems with ground states having zero or small masses. For fermion-antifermion systems, we exhibit a general class of interactions, of the pseudoscalar type, with arbitrary confining potentials, which produce a zero mass pseudoscalar meson bound state. This feature is not altered by the presence of short range vector interactions. For fermion-boson systems, we exhibit a general class of interactions of the vector type, with arbitrary confining potentials, which preserve chiral symmetry except for the free mass terms, and produce an infinite number of light fermions with degenerate masses which are proportional to the free masses of the constituent particles. In the classification scheme of quantum numbers j, l, n these fermions have the quantum numbers $j = l + 1/2; l=o, 1, ..; n=o$. For the massive particles the spectrum displays parity doublets. The introduction of short range vector interactions removes the mass degeneracies but leaves in general unchanged the qualitative feature of the existence of an infinite number of light fermions with increasing spins. We show that the introduction of some additional secondary interactions of the axial vector type, acting as an L-S coupling, might give masses to the high spin light fermions.

12193 **(IPNO-TH—84-62) Off-shell properties of the Paris nucleon-nucleon potential and implications for few-body systems.** Loiseau, B.; Mathelitsch, L.; Plessas, W.; Schwarz, K. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 57p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86750392.

We investigate the half-off-shell properties for the Paris nucleon-nucleon potential and for a separable representation of it. Deuteron bound-state and scattering wave functions as well as Noyes-Kowalski functions are considered. Essential features with respect to elastic electron-deuteron and nucleon-deuteron scattering are discussed. We find that some polarization observables of these processes dismiss certain off-shell behaviours encountered, for instance, in various phenomenological separable potentials.

12194 **(IPNO-TH—84-74) From baryonium to hexons.** Nicolescu, B.; Poenaru, V. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Oct 1984. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86750367.

After a short summary of the theoretical status of fermionic and bosonic constituents of hadrons in the topological bootstrap, two distinctive predictions of this approach -narrow-width baryonia and very high-mass hexons- as well as the relevance of the diquark concept are discussed. In particular, the hexons are expected to reveal a new (TeV) scale of strong interactions.

12195 **(ISN—85-02) Study of light baryons in the three quark cluster model: exact calculations.** Silvestre-Brac, B.; Gignoux, C. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Jan 1985. 45p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86750317.

Within the non relativistic model, all the baryons built with 3 quarks of flavor u, d and s (N, Δ, Λ, Σ, XI, Ξ) are studied with the Bhaduri's potential. It is shown that the free parameter simplest model is able to reproduce most of the experimental properties and allows to extract the rare effects which need more elaborate model. The validity of the description in terms of an harmonic oscillator basis is also tested.

12196 **(ITEP—26(1984)) Interaction potential for three-particle hadronic systems in the large distance limit.** Kobzarev, I.; Martemyanov, B.; Schepkin, M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700393.

The interaction potential for three-particle colour singlet hadronic systems of the type 3q or q anti q + gluon is calculated in the approximation of gluonic tubes. In general case the interaction energy is determined by the tube configuration of the star and is not reducible to the sum of the two-body potentials. The explicit expression for the energy of 3-quark system is obtained and the properties of the case of arbitrary colour charges are discussed. It is shown that if only the volume energy of gluon field tubes is taken into account there exists a large class of tube configurations degenerate with star configuration in energy. The degeneracy is removed by the surface energy contribution.

12197 **(ITEP—75(1984)) Analysis of eigenvalues for the energy dependent potentials and NN interaction in the quark compound bag model.** Grach, I.L.; Kalashnikova, Yu.S.; Narodetskij, I.M.; Shmatikov, Z.Zh. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700394.

The trajectories of eigenvalues of the energy dependent potentials are discussed for the case of NN interaction in the quark compound bag (QCB) model. It is shown that the asymptotic behaviour of eigenvalues for the linearly energy dependent potentials is defined by the coefficient at the linear energy term in the potential. In the QCB model this coefficient depends on the nucleon component admixture in the bag wave function. The results of eigenvalue analysis are illustrated with the simple example of the QCB potential describing phase shifts up to $T <= 0.8$ GeV.

12198 **(ITEP—112(1984)) $^1S_0$ and $^3S_1$ - $^3D_1$ nucleon-nucleon potentials in the quark compound bag model.** Kalashnikova, Yu.S.; Narodetskij, I.M.; Simonov, Yu.A.; Veselov, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700388.

For nucleons interacting via the formation of the quark compound bag (QCB) the resulting potential is written in a general form. Explicit examples of potentials are constructed in the $^1S_0$, $^3S_1$ and $^3S_1$-$^3D_1$ states fitted to the experimental data at $T <$ or approximately 800 MeV. As an outcome the QCB energy levels (dibaryons) and NN admixture in QCB are obtained in good agreement with theoretical predictions.

12199 **(ITEP—114(1984)) Nucleon-nucleon forces in the quark compound bag model and few-nucleon systems.** Kalashnikova, Yu.S.; Narodetskij, I.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700389.

The role of quark-gluon degrees of freedom is discussed in nucleon-nucleon scattering at low and intermediate energies. It is shown that the existence of six-quark hags fixes the form of NN potential at small distances, which leads to the P-matrix satisfying the criterion of Jaffe and Low. The dynamical model of three-nucleon system is discussed taking into account the contribution of six-quark bags.

12200 (ITEP—116(1984)) Fragmentation functions for quarks and diquarks in the model of quark-gluon strings. Kaidalov, A.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700390.

Fragmentation functions of different quarks and diquarks into hadrons are considered in the framework of the quark-gluon string model, based on the topological (1/N)-expansion. Behaviour of the fragmentation functions is determined. It is expressed in terms of the intercepts of the well known Regge-trajectories. A theoretical estimate for the suppression of the heavy quarks (s, c, b...) production is obtained. Interpolation formulae for the fragmentation functions which satisfy all the conservation laws are derived.

12201 (ITEP—152(1984)) Tensor polarization of deuteron in πd and pd backward scattering and multiquark resonances. Kondratyuk, L.A.; Shevchenko, L.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 19p. (CONF-8410220—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700391.

From 2. workshop on spin physics; Serpukhov, USSR (8 Oct 1984).

The relation between tensor polarization in πd and pd backward scattering and contributions of Q^6 and Q^8 resonances is discussed. The dibaryon and tribaryon rotational series should produce structures in the two baryon channel at the energy E=22-3 GeV and three baryon channel at the energy E=3.1-4 GeV. It is shown that such structures are indeed detected in the elastic πd and pd backward cross section.

12202 (ITEP—176(1984)) Production and decay of quark-gluon strings: inclusive distributions of hadrons in psub(tr) and x. Veselov, A.I.; Piskunova, O.I.; Ter-Martirosyan, K.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700392.

The dependence of inclusive cross sections of hadron production in p anti p → hX collisions on transverse momentum Psub(perpendicular) (and also on x, Where x is the Feynman variable, and $\sqrt{s}$) is calculated at high energy in the region of small Psub(perpendicular) < or approximately 1-2 GeV. The model of production and decay of quark-gluon strings is used under the simplest assumptions about the quark transverse momentum Ksub(perpendicular) dependence of the quark distributions in nucleon approximately exp(-γ_1 Ksub(perpendicular)sup(2)) and about the form of the string fragmentation function G tilde approximately exp[-γsup(h)(Psub(perpendicular) vector-ZKsub(perpendicular) vector)sup(2)] where γ_1 and γsup(h) are some constants. Theory reproduces all existing experimental data and yields the "sea-gull effect" for the dependence of <Psub(perpendicular)> on x. Predictions are given for the Psul(perpendicular) dependence of the spectra of π^{+-} mesons produced at high energies at SPS and other future colliders.

12203 (JINR—E-2-84-787) Exact calculations of the lowest-order electromagnetic corrections for the processes $e^+e^- \to \mu^+\mu^-$(tau$^+$tau$^-$). Akhundov, A.A.; Bardin, D.Yu.; Riemann, T.; Fedorenko, O.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700381.

Submitted to the journal Sov. J. Nucl. Phys. .

For the process $e^+e^- \to f^+f^-(\gamma)$ exact expressions are obtained for the fermion energy spectrum and the total cross section to order a^3 in QED without neglecting the particle masses.

12204 (JINR—R-2-85-30) Effective cross section matrix and the isotopic relations between the structure functions of inclusive processes. Lyuboshits, V.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1985. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700399.

Submitted to the journal Sov. J. Nucl. Phys. .

The positive-defined matrix of effective cross sections which is invariant with regard to any transformations of the isotopic rotation group of SU(2) is constructed in the isotopic space of two separated hadrons a_1 and a_2. The properties of this matrix determine the united class of isotopic relations for total cross sections of the interactions of a_1 and a_2 hadrons, for two-particle structure functions of inclusive processes $b_1+b_2 \to a_1+a_2+X$ and for one-particle structure functions of inclusive processes $a_1+b \to a_2+X$.

12205 (JINR—R-2-85-106) Structure radiation in $K \to 2\pi\gamma$ decays. Bel'kov, A.A.; Pervushin, V.N.; Sarikov, N.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1985. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700398.

The structure radiation amplitudes in radiative $K^+ \to 2\pi\gamma$ decays are calculated in one-loop approximation of the chiral theory. It is shown that the structure radiation completely is due to the chiral a anomalies whose contribution correponds to direct magnetic dipole transitions. Absence of an electric dipole transition leads to the invisibility of CP nonconservation effects in $K \to 2\pi\gamma$ decays since the charge asymmetry connected with it may be induced only by the interference between the bremsstrahlung and direct electric dipole transition amplitudes.

12206 (TRI-PP—83-93) Rare decays of neutral π and eta. Poutissou, J.M. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1983. 3p. (CONF-8309163—6). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700376.

From Conference on low energy tests of conservation laws in particle physics; Blacksburg, VA, USA (12 Sep 1983).

The decays of the pseudoscalar neutral mesons π degree and eta degree have provided a test of fundamental principles. The main branch, π degree → 2γ, was investigated in the late 60's in the context of current algebra and the decay rate calculated from the singular triangle diagram is in excellent agreement with experiment. Rare leptonic decays of the neutral pseudoscalar mesons are of interest because of the information they reveal about neutral currents or other exotic interactions between leptons and quarks. The author discusses recent information on the π degree → e^+e^- decay.

12207 (TRI-PP—85-5) CP violation with three generations of Majorana neutrinos. Kopac, J.; Picciotto, C. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1985. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700379.

Analysis of the mixing matrix and mass eigenstates for three generations of Majorana neutrinos is presented. CP violation is analysed and different combinations of CP-violating phases are discussed for various physical processes.

12208 (TRI-PP—85-10) Rate suppression with three generations of Majorana neutrinos. Picciotto, C.; Kopac, J. (TRIUMF, Vancouver, British Columbia (Canada)). Mar 1985. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700378.

Rate suppression with three generations of Majorana neutrinos is analyzed. It is shown that the physically attractive possibility of three equal masses and a relative CP eigenvalue of the first different from the other two can lead to complete cancellation in double-beta decay. An explanation in terms of pseudo-Dirac neutrinos is offered, and the process $\mu^- \to e^+$ is also examined.

12209 (UM-P—84/70) Numerical estimate of nucleon form factors up to momentum transfer squared q^2 approx. 200 GeV^2/c^2. Leverton, P.A.; Lo, S.Y. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700400.

In the geometrical picture the incoherent sum of the opaqueness function as used in the Chou-Yang model has been utilized to obtain nucleon form factors from fitting p anti p → π + anything for momentum transfer squared 9^2 up to 200 GeV^2/c^2. We find that the scaling law for nucleon form factors is violated in the region 9^2 > 10 GeV^2/c^2, and an additional dipole term $(1 + 9^2/50\ \text{GeV}^2)^{-2}$ is needed to fit numerical values.

12210 (UM-P—84/72) Excited quarks and GIM mechanism. Choudhury, S.R.; Ellis, R.G.; Joshi, G.C. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700406.

It is shown that the idea of excited quarks in the range 50-130 GeV is consistent with the Glashow-Iliopoulos-Maiani (GIM) mechanism if their coupling to the quark-gluon system is below a certain limit.

12211 (USIP—85-09) Identification of neutral Higgs bosons in the Delphi detector at Lep. Hulth, P.O.; Hultqvist, K. (Stockholm Univ. (Sweden). Inst. of Physics). Mar 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700407.

A Monte Carlo study has been performed to investigate the possibilities of observing and identifying a neutral Higgs boson in the DELPHI detector using the reaction e^+ to Z sp (o) to H sp (o) $l^+ l^-$. Various methods of identifying the H sp (o) by its decay characteristics as predicted by the Lund Monte Carlo have been considered.

12212 Lattice calculation of weak matrix elements. Bernard, C.; Draper, T.; Hockney, G.; Rushton, A.M.; Soni, A. (University of California, Los Angeles, California 90024; University of California, Irvine, California 92717; and Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **55**: No. 25, 2770-2773(16 Dec 1985).

We present the first results from a small (6^3 x 10) lattice of a calculation of nonleptonic weak matrix elements. The $\Delta I = (1/2)$ rule is studied as a test case. For a lattice meson of mass akaon mass we find a significantly enhanced $\Delta I = (1/2)$ amplitude and a $\Delta I = (3/2)$ amplitude compatible with zero within our statistics. The dominance of the $\Delta I = (1/2)$ amplitude appears to be due to a class of graphs called the eye graphs. Qualitatively similar results are found whether or not the charm quark is integrated out ab initio. We also report preliminary results on other weak matrix elements.

12213 Signatures for horizontal gauge bosons in very energetic hadronic collisions. Bengtsson, H.; Hou, W.; Soni, A.; Stork, D.H. (Department of Physics, University of California, Los Angeles, California 90024). *Physical Review Letters;* **55**: No. 25, 2762-2765(16 Dec 1985).

The signatures for horizontal-gauge-boson production at a $\sqrt{s} = 40$ TeV hadronic collider are studied. Production and decay of the boson leads to very massive lepton pairs (such as $e\mu$ or μtau) in an otherwise quiet event, providing a clean signature. Backgrounds are studied with the Lund Monte Carlo model. The dominant background comes from W^+W^- pairs, but there is good separation of the signal from the backgrround. The identification of tau may be important for horizontal bosons; we note that the tau path lengths could be many tens of centimeters, suggesting new possibilities for their identification.

12214 Evidence against a stable dibaryon from lattice QCD. Mackenzie, P.B.; Thacker, H.B. (Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review Letters;* **55**: No. 23, 2539-2542(2 Dec 1985). Contract AC02-76ER02220.

We have used standard numerical techniques of lattice quantum chromodynamics to look for evidence of the proposed doubly strange spin-zero dibaryon (the H particle), and to determine the splitting between the mass of the H and the mass of two A's, its lightest possible strong-decay channel. We find that the dibaryon is above the two-A threshold, making it unstable to strong decay.

12215 Exclusive decays of heavy mesons into baryons. Damgaard, P.H.; Tsokos, K.; Berger, E.L. (European Organization for Nuclear Research, Geneva, Switzerland; Maryland Univ., College Park, USA; Argonne National Lab., IL, USA). *Nuclear Physics [Section] B;* **259**: No. 2/3, 285-305(23 Sep 1985).

We analyze the decays of heavy meson resonances into baryon-antibaryon final states within the formalism of exclusive processes in QCD. The decay of Jsup(PC)=2^{++} states into proton-antiproton pairs is examined in detail. Predictions are presented for the branching ratios with the proton wave function normalized by data for PSI->p anti p. Predictions for the cross section of charmed resonance production in p anti p collisions are given. We discuss the feasibility of studying b anti b spectroscopy in p anti p collisions as well as the reliability of our predictions.

12216 Capabilities of e^+e collisions for producing very heavy Higgs bosons. Dawson, S.; Rosner, J.L. (Lawrence Berkeley Lab., CA). *Physics Letters [Section] B;* **148**: No. 6, 497-501(6 Dec 1984).

The process e^+e->νanti ν+(Higgs boson) is examined for production of such bosons at masses above 0.4 TeV/c^2. Possible backgrounds, such as e^+e->(soft photons)+W^+W, e^+e->W^+W, and e^+e->tanti t, are examined. It is shown that to produce and detect Higgs bosons of masses (0.4, 0.6, 0.9) TeV/c^2 through this mechanism values of s in excess of (1, 2, 4) TeV^2 will be required. We compare the rates for e^+e->νanti ν+Higgs to those for the standard process e^+e->Z+Higgs.

6453 Particle Invariance Principles And Symmetries

12217 (ISN—83-66) Decomposition of the SO(6) symmetric representations into SU(2)xSU(2)xU(1). Piepenbring, R.; Silvestre-Brac, B.; Szymanski, Z. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Dec 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86750310.

The decomposition of the symmetric irreducible representations of the rotation group SO(6) into a Kronecker product of the irreducible representations of two SU(2) groups and one group U(1) is analysed. Matrix elements of the group generators are calculated explicitly in a closed form. Relations with the Gel'fand-Tsetlin decomposition are indicated. An example of a physical application is given.

6454 Field Theory

REFER ALSO TO CITATION(S) 12046, 12183, 12196, 12197, 12198, 12199, 12200, 12202, 12213, 12414

12218 (CBPF-NF—004/84) New gauge for supersymmetric abelian gauge theories. Smith, A.W.; Barcelos Neto, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700330.

A new gauge for supersymmetric abelian gauge theories is presented. It is shown that this new gauge allows us to obtain terms which usually come as radiative corrections to the supersymmetric abelian gauge theories when one uses the Wess-Zumino gauge.

12219 (CBPF-NF—007/84) High temperature interparticle potential for an alternative gauge model. Doria, R.M.; Helayel Neto, J.A.; Wanyun, Z. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700331.

A thermal Wilson loop for a model with two gauge fields associated with the same gauge group is discussed. Deconfinement appears at high temperature. It is not possible however specify the colour of the deconfined matter.

12220 (CBPF-NF—030/84) Gauge theory for composite fields. Doria, R.M.; Helayel Neto, J.A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700332.

A gauge theory for composite matter fields is proposed. The cases SU(N) x SU(N) and SU(2) x U(1) are studied. QCD can also be reobtained for composite quarks.

12221 **(CBPF-NF—032/84) Two gauge fields in the same group.** Doria, R.M.; Gersdorff, H.P. von; Silva, E.P. da. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 38p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700333.

Two gauge fields undergo gauge transformations belonging to the same group. In this case the concepts of gauge fixing and ghosts are extended. A mixed propagator is obtained.

12222 **(CBPF-NF—041/84) Does QCD have infrared renormalons.** Malbouisson, A.P.C.; Simao, F.R.A.; Sa Borges, J. de. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700384.

A naive perturbative proof of the existence of infrared renormalons for large distance asymptotically free theories is given. It is argued that the extension of the result for small distance asymptotically free theories is not obvious. Indeed infrared renormalons for QCD are not found.

12223 **(CONF-850869—12) Status of perturbative QCD .** Collins, J.C. (Institute for Advanced Study, Princeton, NJ (USA)). 1985. Contract AC02-80ER10712. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004962.

From Meeting of the Particles and Fields Division of the American Physical Society; Eugene, OR, USA (12 Aug 1985).

Progress in quantum chromodynamics in the past year is reviewed in these specific areas: proof of factorization for hadron-hadron collisions, fast calculation of higher order graphs, perturbative Monte Carlo calculations for hadron-hadron scattering, applicability of perturbative methods to heavy quark production, and understanding of the small-x problem. 22 refs. (LEW)

12224 **(DOE/ER/10712—5) [Theoretical elementary particle studies.] Final report, September 1983-July 1985 .** Collins, J.C. (Illinois Inst. of Tech., Chicago (USA). Dept. of Physics). 1985. Contract AC02-80ER10712. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86001165.

The work done during the period September 1983 to July 1985 covers several areas of the theory of the strong interactions of elementary particles, mostly in the area characterized as 'perturbative QCD'. The specific topics are: the proof of factorization for hard processes, such as the Drell-Yan process; calculation of transverse-mementum distributions for these processes; investigation of the small-x region; demonstration of the applicability of perturbative QCD (quantum chromodynamics) to the production of heavy quarks; and improved methods of calculation of the effects of heavy quarks in hard processes, and in particular of their distribution functions in hadrons ('structure functions'). 31 refs.

12225 **(DOE/ER/40048—33-N5) Soliton Bag Model.** Wilets, L.; Bickeboeller, M.; Birse, M.C.; Dethier, J.L.; Goldflam, R.; Henley, E.M.; Luebeck, E.G.; Pirner, H.; Rehr, J.J.; Schuh, A. (Washington Univ., Seattle (USA). Inst. for Nuclear Theory). 1985. 7p. (CONF-8508127—11). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004287.

From Nuclear chromodynamics conference; Santa Barbara, CA, USA (12 Aug 1985).

A summary of recent and current research on the Soliton Bag Model is presented. The unique feature of the model, namely dynamics, is emphasized, since this permits calculation of reactions within the framework of a covariant effective Lagrangian. One gluon exchange effects are included. 17 refs., 3 figs.

12226 **(DOE/ER/40085—9) Renormalization scheme-dependence of perturbative quantum chromodynamics corrections to quarkonia.** Dentamaro, A.V. (Tufts Univ., Medford, MA (USA). Dept. of Physics). May 1985. Contract AC02-83ER40085. 192p. NTIS, PC A09/MF A01; GPO Dep. File Number DE86005060.

Thesis.

QCD radiative corrections to physical quantities are studied using Stevenson's principle of minimal sensitivity (PMS) to define the renormalization. We examine several naive potentials (Cornell group, power law and logarithmic), as well as the more sophisticated Richardson model in order to determine the spectra for the non-relativistic heavy charmonium and bottomonium systems. Predictions are made for the values of hyperfine splittings, leptonic and hadronic decay widths and E1 transition rates for these families of mesons. It is shown that good agreement with experimental data may be achieved by using a constant value of A/sub QCD/, which is determined by the PMS scheme and the potential model.

12227 **(IC—85/9) Multiplet classification of the indecomposable highest weight modules over affine Lie algebras and invariant differential operators: the asub(l)sup((1)) example.** Dobrev, V.K. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700302.

All multiplets of reducible (indecomposable) highest weight modules (HWM) over the affine Lie algebra Asub(l)sup((1)) are classified and parametrized. The reducible HWM are explicitly given in the A_1sup((1)) and A_8sup((1)) cases. New concepts of imaginary Weyl reflections and extended Weyl group for affine Lie algebras are introduced. Function space realization of the HWM and invariant differential operators are given for arbitrary affine Lie algebras with explicit examples A_1sup((1)) case. Current and further research is indicated including applications to integrable systems and to current algebras. Two conjectures are made in the former case.

12228 **(IC—85/13) Multiplets of indecomposable highest weight modules over infinite-dimensional Lie algebras: The Virasoro - A_1 correspondence.** Dobrev, V.K. (International Centre for Theoretical Physics, Trieste (Italy)). Feb 1985. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700301.

The Feigin-Fuchs multiplet classification of the reducible (indecomposable) highest weight modules over the Virasoro algebra is made explicit and complete. The exact correspondence between this classification and the one for the Kac-Moody algebra A_1sup((1)) is found including homogeneity degrees of singular vectors. Possible correspondence between fields in the critical points of statistical physics models and A_1sup((1)) symmetric fields is proposed.

12229 **(IC—85/14) Coupling of Yang-Mills to N=4, d=4 supergravity.** Bergshoeff, E.; Koh, I.G.; Sezgin, E. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1985. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700316.

We couple N=4, d=4 supersymmetric Yang-Mills theory to supergravity. The scalars of the theory parametrize the coset ((SO(n,6) / SO(n) x SO(6)) x ((SU(1,1) / U(1)). Keeping the composite local SO(n) x SO(6) x U(1) invariance intact, we gauge an (n + 6) parameter subgroup of SO(n,6) which is either (i) SU(2) x SU(2) x H (dim H=n), (ii) SO(4,1) x H (dim H=n-4) or (iii) SO(6,1) x H (dim H=n-15). In all these cases the theory has an indefinite potential.

12230 **(IC—85/19) Anomaly freedom in chiral supergravities.** Salam, A.; Sezgin, E. (International Centre for Theoretical Physics, Trieste (Italy)). Feb 1985. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700317.

We give criteria for anomaly cancellations in chiral Yang-Mills supergravities (including dual formulations of the theories) in 6, 8 and 10 dimensions.

12231 **(IC—85/28) Analogue of the Witten effect in the Poincare gauge theory of gravity.** Mielke, E.W. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1985. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700318.

The gravitational contribution to the chiral anomaly is analysed in the framework of the Poincare gauge theory. It is shown that an additional CP-violating term 8*RR in the effective Lagrangian is equivalent to a shift in the mass of the Taub-NUT metric as felt by fermions. This analogue of the Witten effect is discussed in conjunction with the appearance of torsion in recently found exact solutions.

12232 (IFT-P—12/84) 2-dimensional N=2 Wess-Zumino model on the lattice; from Dirac-Kaehler formalism to the Nicolai mapping. Aratyn, H.; Bessa, P.F.; Zimerman, A.H. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700334.

A treatment of the supersymmetric Wess-Zumino N=2 two dimensional model in the discrete space-time is presented. A pure differential form approach to the superspace formalism which enables us to obtain the corresponding super-symmetric Dirac-Kaehler Lagrangian is proposed. It is shown that the discretized supersymmetric model can be alternatively constructed from Nicolai mapping on the lattice.

12233 (IFT-P—13/84) Superspace in the Dirac-Kaehler framework in two dimensions. Aratyn, H.; Schiffer, M.; Zimerman, A.H. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700335.

In an attempt to describe the rigid superspace on the Clifford algebra of differential forms, the two dimensional supersymmetric gauge field theory is presented explicitly as an example. Use is only made of the Clifford product and Dirac-Kehler operator on the basis of differential forms with the spinorial Lorentz transformation law.

12234 (IFT-P—16/84) Quasiclassical approximation for ultralocal scalar fields. Francisco, G. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1984. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700319.

It is shown how to obtain the quasiclassical evolution of a class of field theories called ultralocal fields. Coherent states that follow the 'classical' orbit as defined by Klauder's weak corespondence principle and restricted action principle is explicitly shown to approximate the quantum evolutions as $(h/2\pi) \rightarrow 0$.

12235 (IFT-P—17/84) Aspects of hadronic structure. Ferreira, P.L. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1984. 18p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700385.

An overview of the current phenomenological models of hadron structure, whose theoretical basis is the Quantum Chromodynamics (QCD), is presented. A short introduction to the QCD permits to focalize the relevant properties which are attached to those models. Following, bag-like models (in particular, MIT bag and chiral extensions) and potential-like models among them the Karl and Isgur non-relativistic model and a semi-relativistic model, free of the Klein paradox, with equal scalar-vetorial mixture of confinement potential are shortly studied. Enphasis is given to the baryons, treated, basically, as three-quarks systems.

12236 (IFUSP-P—466) Decay rate of the false vacuum at high temperatures. Eboli, O.J.P.; Marques, G.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700320.

Within the semiclassical approach, the high temperature behaviour of the decay rate of the metastable vacuum in Field Theory is investigated. It is shown that, contrarily to what has been proposed in the literature, the pre-exponential factor exhibits a non-trivial dependence on the temperature. Furthermore, this dependence is such that at very high temperatures it is as important as the exponential factor and consequently it spoils many conclusions drawn up to now on Cosmological Phase Transitions.

12237 (IFUSP-P—478) Percolation temperature and the 'instability' of the effective potential. Carvalho, C.A. de; Bazeia Filho, D.; Eboli, O.J.P.; Marques, G.C.; Silva, A.J. da; Ventura, I. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700336.

It is shown that in spontaneously broken lambda phi^4 theory the percolation temperature coincides with the temperature at which the semiclassical (loop) expansion of the effective potential (free energy) of the system around a uniform field configuration fails. This allows us to extract the percolation temperature directly from the effective potential. The addition of fermions or gauge fields does not alter the result as long as they are weakly coupled to the scalars. The coincidence holds in the high temperature limit at every order in the loop expansion.

12238 (IFUSP-P—486) Gentilionic approach to quark colours. Cattani, M.S.D.; Fernandes, N.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700402.

An extended form of Noether's theorem enable us to identify the colour quantum number with the eigenvalue of the invariant of the algebra of S sup((3)). In the gentilionic approach, the composition of the S sup((3)) colour with the symmetric quark model seems to constitute an exact symmetry of Nature. It is also argued some general properties and the universality of Gentile statistics.

12239 (IFUSP-P—492) Gentilion hypothesis for quark colours. Cattani, M.S.D.; Fernandes, N.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 14p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700403.

Extending the Noether's theorem it is possible to identify the colour quantum numbers with the eigenvalue of a S sup((3)) algebra invariant. In the gentilion approximation, the composition of the coloured S sup((3)) with the symmetric quark model seems to constitute in an exact symmetry of the nature. Some general properties related with the observationality in Quantum Mechanics are also approached and the Gentile statistical universality is asserted.

12240 (IFUSP-P—493) Grassmann-Schoenberg algebras and grand unification. Fernandes, N.C. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 27p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. File Number DE86700337.

Some algebraic concepts developed by M. Schoenberg in order to apply it in the unification schemes of basic interactions are presented.

12241 (IFUSP-P—501) Quantization of the fermionic sector in N=1, D=11 supergravity. Jasinschi, R.S.; Smith, A.W. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700338.

It is shown that the fermionic sector of N=1, D=11 supergravity can be rearranged in such a way that a minimal number of auxiliary fields are necessary to be introduced so that the quartic gravitino interaction terms can be eliminated. After functional integration over the gravitino a effective action in terms of these auxiliary fields and the bosonic fields of N=1, D=11 supergravity is obtained. The non-vanishing expectation value of these auxiliary fields can lead to mass-like terms for the gravitino and contributions so the cosmological constant.

12242 (ISN—84-36) Memory function approach to retardation effects in the relativistic two-body problem. Bilal, A.; Schuck, P. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Aug 1984. 84p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86750320.

The memory function approach is applied to the relativistic two particle problem. We thus obtain integral equations similar to the Bethe-Salpeter equation, taking all retardation effects fully into account and eliminating the relative time variable. The formalism is studied for scalar Klein-Gordon fields as well as for spinorial Dirac fields. For both cases the memory function and the integral kernels are calculated for a given model explicitely. The scalar-scalar model of Cutkosky is treated in detail and numerical binding energies are obtained, very close to those of the original Bethe-Salpeter equation, thus showing the extreme importance of retardation effects. As an example for Dirac fields the memory function for a proton-antiproton pair interacting via exchange of a π^0 is established.

12243 **(ITEP—87(1984)) Nature of the scalar resonance delta (980).** Shabalin, E.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700395.

Analysis based on using the model of the effective chiral Lagrangian describing s- and p-wave states of anti qq system makes it possible to identify the resonance delta (980) with p-wave state of anti qq.

12244 **(ITEP—108(1984)) QCD Hamiltonian in the polar representation.** Simonov, Yu.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700387.

A polar representation is suggested for the SU(2) Yang-Mills vector potential which is preserved by gauge transformations. This enables one to separate out explicitly gauge degrees of freedom in the Hamiltonian formalism. The resulting Hamiltonian contains all instantaneous interaction between color charges and admits in addition to usual perturbative expansion in powers of g also an expansion in powers of 1/g. In the first term of that expansion space derivatives are absent, hence propagation is not possible.

12245 **(ITF—84-184-R) Hopf equation for an infinite-dimensional phase space dynamical system and Euclidean quantum field theory.** Chueshov, I.D. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1984. 36p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE86700321.

The question of the construction and properties of the stationary solutions of the Hopf equation corresponding to the infinite-dimensional phase dynamical system is discussed. The ideas and method of Euclidean quantum field theory are employed. As examples, the nonlinear wave equation and the nonlinear plate oscillations problem are considered.

12246 **(JINR—E-2-84-606) One-loop corrections to pion form factor in QCD in a light-like gauge.** Khalmuradov, R.S.; Radyushkin, A.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700396.

Submitted to the journal Sov. J. Nucl. Phys. .

In the framework of the perturbative QCD in a light-like axial gauge the one-loop corrections are calculated to the coefficient function of the operator expansion for the asymptotic behaviour of the pion form factor. The dependence of the results on the choice of renormalization and factorization schemes is investigated.

12247 **(JINR—E-2-85-95) Property of Euclidean Green functions of SU(2) Yang-Mills fields in BPST-instanton background.** Doerfel, B.; Geyer, B.; Muelsch, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700322.

Applying the A. Rouet method to pure SU(2) Yang-Mills theory in the background of the BPST-instanton configuration it is shown that the (Euclidean) on-shell Green functions of-transverse gauge fields in the instanton background are obtained from appropriately determined Green functions in the perturbative vacuum by a mere translation.

12248 **(JINR—E-2-85-160) Irreducible *-representations of Lie superalgebras B(O,n) with finite-degenerated vacuum. Results for B(O,1).** Blank, V.; Havlicek, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1985. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700339.

The general method of constructing inreducible *-representations of Lie subalgebras B(O, n) presented in the first part of this study is applied to the B(0, 1) subalgebra. A one-parameter family 2 of non-equivalent irreducihle *-representations with non-regenerated vacuum is obtained. The domain Dsub(π) of each π epsilon PI is dense in $L^2(R^+)xC^2$ and for all elements of B(0, 1) satisfying $z=z^*$ the operators $\pi(Z)$ are essentially self-adjoint on Dsub(π). The restriction of π to the even subalgebra sl(2, R) of the real form osp (1, 1) of B(0, 1) equals direct sum of two skew-symmetric irreducible representations of sl(2, R) on $L^2(R^+)$ that are integrable to unitary irreducible representations of the universal covering group of SL(2, R).

12249 **(JINR—R-2-84-534) Evolution kernels in QCD: two-loop calculation in the Feynman gauge.** Mikhajlov, S.V.; Radyushkin, A.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 32p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE86700397.

Submitted to the journal Nucl. Phys., B.

A new method of calculating the nonsinglet evolution kernels in QCD is described. This method is applicable to exclusive and some inclusive ("space-like") processes. As an application of the method the two-loop contribution to the pion wave function evolution kernel V is calculated in the Feynman gauge. In the same way also the two-loop kernel P of the nonsinglet Lipatov-Altarelli-Parisi evolution equation is reproduced. For some classes of diagrams general properties are established that hold in all orders of perturbation theory. The reduction formulas are found that enable one to calculate a P kernel from the corresponding V kernel. The general structure of the 2 loop evolution kernels are discussed and results are compared with those obtained by other authors.

12250 **(JINR—R-2-84-649) Topological color confinement.** Pervushin, V.N.; Azimov, R.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700323.

Submitted to the journal Sov. J. Nucl. Phys. .

The effect of spontaneous topological vacuum degeneration for gauge fields in a finite-volume space is discussed. The quantum theory for non-Abelian fields with such degeneration is formulated. The colorless sector of the generating functional of Green functions for the theory within the infinite-volume limit is shown to coincide with the Faddeev-Popov functional integral, and the Green functions of color fields disappear because of the quantum interferometric effect of the Bomb-Auronov type. For finite volume in the theory arise additional low-energy interactions, which destroy U(1) chiral and CP-symmetries.

12251 **(JINR—R-2-85-6) Renormalizations in quantum field theory.** Shirkov, D.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1985. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700324.

Formal aspects and physical contents of the renormalization procedure in quantum field theory, as well as its relation to ultraviolet divergencies and the penormalization group are considered. It is shown that the occurrence of the dimensional "parameter of scale" is due to quantization rather than to the subtraction of infinities.

12252 **(LA-UR—85-4451) Improved Monte Carlo Renormalization Group Method.** Gupta, R.; Wilson, K.G.; Umrigar, C. (Los Alamos National Lab., NM (USA); Cornell Univ., Ithaca, NY (USA)). 1985. Contract W-7405-ENG-36. 5p. (CONF-8509213—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004750.

From Frontiers of quantum Monte Carlo conference; Los Alamos, NM, USA (3 Sep 1985).

An extensive program to analyse critical systems using an Improved Monte Carlo Renormalization Group Method (IMCRG) being undertaken at LANL and Cornell is described. Here we first briefly review the method and then list some of the topics being investigated. 9 refs.

12253 **(TRI-PP—85-3) Potential model for quark confinement.** Thaler, J.; Iqbal, M.J. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1985. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700325.

A static quark potential model obtained from a relativistic wave-equation is considered. The long-part of the quadratic terms is suppressed by a glueball exchange mechanism and compatibility with the meson spectra is shown.

12254 **(TRI-PP—85-4) Lattice results on the meson electric form factor.** Wilcox, W.; Woloshyn, R.M. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1985. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700326.

A calculation is outlined and results presented for the electric form factor, measured at two values of the momentum, of the pseudo-Goldstone meson within the staggered formulation of lattice fermions.

12255 **(TRI-PP—85-7) Effects of anomalous Zsup(O) decays on neutrino counting near the Zsup(O).** Godfrey, S.; Ng, J.N.; Kalyniak, P. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1985. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700327.

We study the implications of the anomalous Zsup(O) decays on neutrino counting in esup(+) esup(-) collisions. The Zsup(O)→l anti lν vertex is parametrized by an effective Lagrangian, Lsub(eff), satisfying U(1)sub(em) gauge invariance, CP and chirality conservation. The parameters of Lsub(eff) are constrained by the ratio r(Z→l anti lν)/ r(Z→l anti l), Bhaba scattering, and low energy νsub(μ)e scattering data. We find that the effect on neutrino counting can be significant but depends on the magnitude and relative signs of the parameters in Lsub(eff). We also find that accurate measurements of the cross section σ(esup(+) esup(-)→ν anti $\nu\gamma$) at the Zsup(O) peak can be used as a sensitive test for new physics.

12256 **(UFPB-DF—15/84) Some remarks about the classical Wilson loop for a class of gauge field copies.** Bezerra, V.B. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica). 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700328.

Ordered integrals along circles for a class of potentials that are given the same field strength are computed. The asymptotic behaviour of the Wilson Loop associated to these potentials is discussed.

12257 **(UFPB-DF—16/84) Influence of cusps and intersections on the calculation of the Wilson loop in ν-dimensional space.** Bezerra, V.B. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700329.

A discussion is given about the influence of cusps and intersections on the calculation of the Wilson Loop in ν-dimensional space. In particular, for the two-dimensional case, it is shown that there are no divergences.

12258 **SO(4) Reduction of the SU(N) Yang—Mills—Dirac equations.** Legare, M.; Harnad, J. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Journal of Mathematical Physics (New York);* **27**: No. 2, 620-626(Feb 1986). Contract AC02-76ER03069.

The equations in compactified Minkowski space that describe SU(N) Yang—Mills fields minimally coupled to Dirac spinor fields transforming under the lowest-dimensional representation(s) of SU(N) are reduced by the action of an SO(4) subgroup of the conformal group of space-time. The reduced systems can be interpreted as Hamiltonian systems with symmetry constrained by a condition on the associated moment maps.

12259 **Covariant method for soliton matrix elements.** Ralston, J.P. (Los Alamos National Laboratory, Theory Division, T-8, MS B285, Los Alamos, New Mexico 87545 and Department of Physics and Astronomy, University of Kansas, Lawrence, Kansas 66045). *Physical Review [Section] D: Particles and Fields;* **33**: No. 2, 496-505(15 Jan 1986). Contract FG02-85ER40214.

We construct field-theory wave functions for soliton and other collective states in field theory. The formalism is covariant, incorporates zero modes, and the states can be directly related to states postulated in the standard Hamiltonian quantization procedures. By explicitly constructing the states using a generalized coherent-state expansion, we present the calculation of matrix elements of functions of operators in a general linearization scheme and reduce such calculations to ordinary functions of classical fields. The results include the dependence of matrix elements on a regularization scale μ^2, momentum transfer q/sup μ/, the overlap of states having different position indices, and the classical configuration. We construct momentum eigenstates and examine the semiclassical limit h→0. Although most of the analysis is expressed in free-field or plane-wave modes for definiteness, the generalization to modes defined by an arbitrary linearization procedure is presented. We also discuss the separation of divergences from zero-point fluctuations versus classical divergences from topological sectors.

12260 **Induced charges and tunneling in soliton-antisoliton systems.** Jaroszewicz, T. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). *Physical Review [Section] D: Particles and Fields;* **33**: No. 2, 575-577(15 Jan 1986). Contract AC02-76ER03064.

Two concepts of induced fermion charge are discussed: the "adiabatic charge" built up by continuous changes of background fields and the "spectral charge" defined in terms of spectral asymmetry of the pertinent Dirac Hamiltonian. These two notions can be related by taking into account tunneling effects in a soliton-antisoliton system.

12261 **Low-energy theorems from scale currents.** Acharya, R.; Fuchs, N.H. (Department of Physics, Arizona State University, Tempe, Arizona 85287). *Physical Review [Section] D: Particles and Fields;* **33**: No. 2, 605-606(15 Jan 1986).

Low-energy theorems involving the trace anomaly in the chiral limit of QCD are derived from the Ward identity for the scale currents. The result is compared with that obtained from a renormalization-group approach.

12262 **Velocity of sound in SU(3) lattice gauge theory.** Gavai, R.V.; Gocksch, A. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **33**: No. 2, 614-616(15 Jan 1986). Contract AC02-76CH00016.

Using Monte Carlo methods we calculate the velocity of sound in both the confining and deconfining phases of QCD. The results are consistent with the theoretical expectations based on an ideal gas of glueballs and gluons, respectively.

12263 **Naturalness for multiscalar models and radiative stability.** Frere, J.; Yao, Y. (Randall Laboratory of Physics, University of Michigan, Ann Arbor, Michigan 48109). *Physical Review Letters;* **55**: No. 22, 2386-2389(25 Nov 1985).

We show that for a class of models in which the Higgs doublets which couple to the up quarks can communicate with those to the down quarks only via mass mixing, the requirement that there should be no flavor-changing neutral processes at the tree level is stable under radiative corrections to the one-loop order. This also implies, in the context of effective-field theories, that we may use the low-energy Lagrangean to calculate one-loop corrections. At the two-loop level, however, heavy particles in the complete yet unknown theory are likely to come into play.

12264 **Derivative expansion of the effective action.** Cheyette, O. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720). *Physical Review Letters;* **55**: No. 22, 2394-2397(25 Nov 1985). Contract AC03-76SF00098.

A method is described for the calculation of derivative terms in the effective action to one loop. Sample calculations are made of the two and four derivative terms for a single scalar field, and of the two derivative terms for O(N) scalar field theory.

12265 **Low-energy predictions of a two-loop finite supersymmetric SU_5 theory.** Bjoerkman, J.E.; Jones, D.R.T.; Raby, S. (Colorado Univ., Boulder, USA. Dept. of Physics; Los Alamos National Lab., NM, USA. Theory Group). *Nuclear Physics [Section] B;* 259: No. 2/3, 503-532(23 Sep 1985).

We present a detailed discussion of a two-loop finite supersymmetric SU_5 theory, with particular emphasis on the new particle mass spectrum and its dependence on the input parameters. The model predicts sin²thetasub(w)=0.237, msub(b) / msub(tau)approx.= 1.8 (at Msub(W)) and Msub(X)=5.3 x 10^{15} GeV, which means that nucleon decay, if observable, will be to strange final states. We find in general msub(g) >msub(q) >msub(e), and that results consistent with a supersymmetric explanation of the CERN monojet and "top-quark" events are possible, in which case we predict light (O(20 GeV)) charged scalar leptons.

12266 **Quarkonia spectra from lattice gauge theories.** Campostrini, M. (Brookhaven National Lab., Upton, NY). *Physics Letters [Section] B;* 147: No. 4/5, 343-346(8 Nov 1984).

A quark-antiquark potential obtained from a Monte Carlo simulation for the pure SU(3) lattice gauge theory is modified for light quark effects and used to calculate charmonium and beautonium spectra. Results are in good agreement with experimental data.

12267 **Infrared finiteness in quantum electrodynamics.** Kawai, Takahiro; Stapp, H.P. (Kyoto Univ., Japan. Research Inst. for Mathematical Sciences; Lawrence Berkeley Lab., CA, USA). pp 263-266 of Group representations and systems of differential equations. Proceedings of a symposium held at University of Tokyo from December 20 until December 27, 1982. Okamoto, K. Amsterdam, Netherlands; North-Holland (1984). (CONF-8212105—).

From Symposium on group representations and systems of differential equations; Tokyo, Japan (20 Dec 1982).

The authors report some mathematical aspects of a recent solution of the infrared catastrophe in quantum electrodynamics. A principal result is that the coordinate space Feynman function can be separated into two factors the first of which is a unitary operator in photon space representing the classical electro-magnetic contribution to the amplitude, and the second of which is a residual factor representing the quantum fluctuation about the classical contribution. The main objectives were to verify: (i) the residual factor is free of infrared divergences, and (ii) the dominant part of the singularity of the residual factor on the positive-α Landau surface has the same analytic form as it would have if the photons were massive.

65 PHYSICS II

12268 **(ANAEM-FR—84) Progress report 1984.** (Ankara Nuclear Research and Training Center (Turkey)). 1984. 58p. (In Turkish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701208.

This report of the Ankara Nuclear Research and Training Center gives a general survey of the activities and research work done in 1984. The research areas are: Physics, Chemistry, Health Physics, Electronics and Nuclear Information.

12269 **(CNAEM-FR—83) Progress report of Cekmece Nuclear Research and Training Center 1983.** (Cekmece Nuclear Research and Training Center, Istanbul (Turkey)). 1984. 6p. (In Turkish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701209.

This report of the Cekmece Nuklear Research and Training Center gives a general survey of the activities research work done in 1983.

12270 **(INDC(NDS)—159/LNA) Report of the Nuclear Data Section to the International Nuclear Data Committee March 1983 - August 1984.** Lorenz, A. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Aug 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701210.

This progress report of the IAEA Nuclear Data Section covers the 18-months period March 1983 - August 1984. It describes past, current and planned activities of the Section and presents the status of its nuclear data centre services and technology transfer.

12271 **(INDC(SEC)—89/UN) INDC list of correspondents for the exchange of nuclear data information and compilation of National Nuclear Data Committees.** (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jul 1984. 123p. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701205.

The report is presented in five sections. In the first section a detailed description of the INDC distribution categories, distribution codes and document designator codes is given. The second section describes the aims, organization and objectives of individual national nuclear data committees. The third section lists names and addresses in alphabetical order within each state or international organization; INDC document distribution code(s), committee membership and/or area of specialization are indicated, where applicable, for each person. This is followed by four shorter lists, indicating the names of individuals in each distribution category, sorted by country or international organization, and the total number of individuals in each category. The final section provides the names of nuclear data committee members also listed by country or international organization.

12272 **(INIS-mf—10041) Physics in Austria. Results of an investigation.** Ehlotzky, F. (Oesterreichische Physikalische Gesellschaft, Vienna; Innsbruck Univ. (Austria)). Jul 1985. 355p. (In German). NTIS (US Sales Only), PC A16/MF A01. File Number DE86701207.

This catalogue gives the results of an investigation on research institutes in Austria in the field of physics, including nuclear physics, which was performed by the Austrian Physical Society. The main part is on university institutes, but also other research institutes are listed. For each institute the name of the head, number of researchers, a short description of the scientific work and an overview of national and international cooperation is given. Various registers and indexes are attached.

6510 Nuclear Physics

12273 **(CEA-N—2411-Vol.1) Progress report 1983. Physics. Vol. 1.** (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 1984. 216p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE86750389.

This report presents the work of these last three years of research in physics conducted in the DRF-G (Department of Fundamental Research of Grenoble). The research activities are conducted in five sections or laboratories: Solid-State physics Section, Magnetic Resonance Section, Hyperfine Interaction Laboratory and Nuclear Physics Laboratory. Researchs in nuclear physics is according to 3 axes: -fission study, -heavy ion physics at intermediate energies, -antiproton-nucleus interactions, field not explored between 5 MeV and 1 GeV. In physical metallurgy, studies are essentially concerned with crystalline and amorphous systems. Semi conductors are also the object of deepened investigations. Magnetism is a priority topic in fundamental research. In this field, rare earths and actinides studies are dominating researches. A topic introduced recently is hydrogen influence on magnetism. The molecular physico-chemical aspect is also studied.

12274 **(DOE/ER—0253) Nuclear physics program plan.** (USDOE Office of Energy Research, Washington, DC). Nov 1985. 125p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86004553.

The nuclear physics program objectives, resources, applications and implications of scientific opportunities are presented. The scope of projected research is discussed in conjunction with accelerator facilities and manpower. 25 figs., 2 tabs. (WRF)

12275 **(DOE/ER/01067—24) Triangle Universities Nuclear Laboratory annual report - TUNL XXIV, 1 July 1984-31 August 1985.** (Triangle Universities Nuclear Lab., Durham, NC (USA)). 1985. Contract AC05-76ER01067;AS05-76ER02408;AS05-76ER03624. 220p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86003851.

Research programs of the Triangle Nuclear Laboratory are discussed. These studies are based on reactions induced by polarized beam, protons, deuterons and neutrons. Individual programs are cataloged separately. (WRF)

12276 **(DOE/ER/04699—9) Search for the formation of the quark-gluon plasma by measurement of cross sections for direct photons and leptons. Annual progress report, April 1, 1985-March 31, 1986.** Kirk, P.N. (Louisiana State Univ. and Agricultural and Mechanical Coll., Baton Rouge (USA)). Dec 1985. Contract AS05-76ER04699. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004471.

The VAX 11/750 computer system for data analysis is described. The design and construction details of multiwire proportional counters are given. (WRF)

12277 **(DOE/ER/04721—9) Experimental nuclear and radiochemistry. Progress report and review, 1984.** Karol, P.J. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Chemistry). 1984. Contract AC02-78ER04721. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004407.

Investigations (theoretical and experimental) of deep spallation reactions are discussed. The spallation mechanism is studied via the products far from stability with deconvolution of cascade and relaxation steps. Experimental studies are proton reactions with medium mass nuclei. The theoretical model involves separate examinations of the cascade step and the relaxation step (evaporation). 45 refs., 18 figs., 8 tabs. (WRF)

12278 **(INDC(NDS)—157/GE) Coordination of the international network of nuclear structure and decay data evaluators. Summary report of a consultants' meeting organized by the IAEA and held at the Fachinformationszentrum in Karlsruhe, FRG, 3-6 April 1984.** Lorenz, A. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Sep 1984. 30p. (CONF-8404285—Summ.). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701204.

From Consultants meeting on coordination of the international network of nuclear structure and decay data evaluators; Karlsruhe, F.R. Germany (3 Apr 1984).

This meeting of the International NSDD (Nuclear Structure and Decay Data) Network dealt with problems related to both the coordination of the NSDD network of centres and groups and to physics questions related to the evaluation of NSDD. The status of the mass-chain and nuclear structure data is reviewed and the planned activities are presented.

12279 **(JAERI-M—83-041) Proceedings of the 1982 seminar on nuclear data.** Murata, T.; Asami, T.; Igarasi, S.; Mizumoto, M. (eds.). (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Japanese Nuclear Data Committee). Mar 1983. 244p. (In Japanese). (NEANDC(J)—90/AU; INDC(JAP)—77/G; CONF-821193—). NTIS (US Sales Only), PC A11/MF A01. File Number DE83902446.

From JAERI seminar on nuclear data; Tokai, Japan (24 Nov 1982).

The 1982 Seminar on Nuclear Data was held on November 24 and 25, 1982 in Tokai Research Establishment of JAERI, by Japanese Nuclear Data Committee (JNDC). The proceedings contain the texts of the commemorative talk for the 20th anniversary of JNDC, the review talks on the nuclear data activity in JNDC, the topical discussion, and the panel discussion by users, evaluators and experimenters. Topics covered include: the theory of preequilibrium process, a new statistical method and the sensitivity analysis for FBR; the nuclear data needs for FBR burn-up calculation, and for fusion integral experiment; status of JENDL-3. Given are the papers presented and the discussion made at the seminar.

12280 **(LA—10513-PR) Applied Nuclear Science Research and Development progress report, June 1, 1984-May 31, 1985.** Arthur, E.D.; Mutschlecner, A.D. (comps.). (Los Alamos National Lab., NM (USA)). Sep 1985. Contract W-7405-ENG-36. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004156.

This progress report describes the activities of the Los Alamos Applied Nuclear Science Group for June 1, 1984 through May 31, 1985. The topical content includes the theory and evaluation of nuclear cross sections; neutron cross section processing and testing; neutron activation, fission products and actinides; and core neutronics code development and application. 70 refs., 31 figs., 15 tabs. (WRF)

12281 **(LA—10550-C) Proceedings of the LAMPF workshop on pion double charge exchange.** Baer, H.W.; Leitch, M.J. (eds.). (Los Alamos National Lab., NM (USA)). Sep 1985. Contract W-7405-ENG-36. 432p. (CONF-850162—). NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE86004174.

From Double charge exchange workshop; Los Alamos, NM, USA (10 Jan 1985).

Experimental and theoretical aspects of double-analog, non-analog, and continuum pion double charge exchange in the 50- to 310-MeV energy range are covered. Separate abstracts were prepared for 22 papers in these proceedings.

12282 **(LA-UR—85-2991) Studies of nuclear structure via polarizstion transfer experiments.** Moss, J.M. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 19p. (CONF-8509206—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017540.

From RCNP-KIKUCHI summer school; Osaka, Japan (1 Sep 1985).

Inelastic scattering and charge exchange reactions at medium energies are discussed. Theoretical treatments of these phenomena based on the Dirac equation are presented. A LAMPF experiment in which polarization observables were employed in the search for collective effects in the nuclear pion field is discussed. This experiment is compared with the EMC (European Muon Collaboration) effect. 37 refs., 11 figs. (WRF)

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 11839, 12065, 12308

12283 **Study of magnetic moments of nuclear excited states at TRISTAN.** Hill, J.C.; Wohn, F.K.; Wolf, A.; Berant, Z.; Gill, R.L.; Kruse, H. (Ames Lab., IA, USA; Brookhaven National Lab., Upton, NY, USA; Michigan State Univ., East Lansing, USA). *Hyperfine Interactions;* **22**: No. 1-4, 449-457(Mar-May 1985). (CONF-8408123—).

From International symposium on nuclear orientation and nuclei far from stability; Leuven, Belgium (28 Aug 1984).

Facilities at the TRISTAN mass separator for measurement of magnetic moments of nuclear excited states are described and recent results for the N = 82 isotones are presented.

6512 Nuclear Properties And Reactions, A=1-5, Theoretical

REFER ALSO TO CITATION(S) 12289, 12362, 12370, 12372

12284 **(CEA-CONF—7794) Antiproton-nucleon physics at LEAR.** Duclos, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1985. 11p. (In French). (CONF-8502101—6; DPh-N-S—2230). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750368.

From 8. biennial session on nuclear physics; Aussois, France (4 Feb 1985).

Antiproton beams from LEAR have been supplied in 1984 to 16 experiments about 10^{12} particules at 200, 300, 600 and 1500 MeV/c have been delivered during 60 days of machine time. In nuclear physics, anti p-nuclei scattering and atomic X rays have been

measured. In hydrogen, atomic L and K transitions have been detected. Searches have been made for baryonia with rather negative results. The p anti p annihilation at rest in various meson channels, selecting the initial anti p-wave, has been observed. The annihilation in electron-positron pair at rest and in flight has been measured and a value of the proton form factor is derived.

12285 **(CEA-CONF—7801) Study of the ^{3}He(γp)np reaction in the region of the resonance Δ(1232).** D'Hose, N.; Audit, G.; Bloch, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1985. 8p. (In French). (CONF-8502101—4; DPh-N-S—2242ter). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750356.

From 8. biennial session on nuclear physics; Aussois, France (4 Feb 1985).

We have studied three-body photodesintegration of ^{3}He in the Δ(1232) resonance region using a quasi-monochromatic photon beam. Proton spectra, measured in three different kinematical conditions are compared to an impulse approximation theoretical model which inlcudes final state interaction.

12286 **(ITEP—183(1984)) Existence of ^{4}H resonances.** Badalyan, A.M.; Belova, T.I.; Konyukhova, N.B.; Efros, V.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700427.

The poles of the four-nucleon amplitUde (T=1, S=0, or S=1, where T is the isospin and S is the spin) are calculated in the framework of a microscopic approach with central NN forces. The P-wave ^{4}H resonances occur at Esub(R) approximately equal to 4.7-12.7 MeV (S=1) and Esub(R) approximately equal to 6.4-13.7 MeV (S=0) above the t+n mass. The resulting values of the reduced width and the channel radius for S=1 turn out to be close to the phenomenological parameters of ^{4}H resonance with Jsup(P) = 2^- experimentally observed.

12287 **(LYCEN—8437) Real and virtual pions in nuclei.** Giraud, N. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire; Lyon-1 Univ., 69 - Villeurbanne (France)). Feb 1984. 105p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE86750352.

The thesis first part is concerned with physical pion interaction with deuton, studied in a three-body problem frame. The elastic cross-section in the energy range near the resonance (3-3), has been deduced taking in account the pion virtual absorption. The second part is concerned with virtual pion in nuclei. In particular the virtual pion cloud around the nucleus has been studied and the effective constant coupling pion-nucleus has been deduced. This one is strongly reduced by polorazation effects of the nuclear medium (essentially by virtual excitation of the Δ isobar), in relation to its value for free nucleon collection. In the frame of the same polarization model, the pion field inside the nucleus has been studied also. This field is lowered for small momentum transfer. It is increased for large momentum transfer. This last phenomenon corresponds to critical opalescence related to phase transition of pion condensation.

12288 **(TRI-PP—85-28) Radiative reactions in two and three nucleon systems.** Fearing, H.W. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). May 1985. 15p. (CONF-850535—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900324.

From European symposium on few-body physics - mesons and light nuclei III; Bechyne Castle, Czechoslovakia (27 May 1985).

Several of the interesting radiative processes involving few nucleon systems at medium energies are discussed, with emphasis on what is interesting about the reaction, what is currently known both theoretically and experimentally, and what should be done next. Reactions considered are proton-proton bremsstrahlung, neutron-proton bremsstrahlung, neutron-proton radiative capture and deuteron photodisintegration, and three body processes such as p + d → ^{3}He + γ. 68 refs., 17 figs.

12289 **Polarization in three-nucleon breakup: Experiment and theory.** Brown, R.E.; Hardekopf, R.A.; Jarmie, N.; Correl, F.D.; Lambert, J.M.; Treado, P.A.; Slaus, I.; Schwandt, P.; Jacobs, W.W.; Meyer, H.O. (Los Alamos National Lab., NM, USA; Naval Academy, Annapolis, MD, USA; Georgetown Univ., Washington, DC, USA. Dept. of Physics; Institut Rudjer Boskovic, Zagreb, Yugoslavia; Indiana Univ., Bloomington, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 356-360(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as report LA-UR--84-3518; CONF-841117--26.

A variety of analyzing powers for d + p breakup reactions initiated by polarized deuterons incident on protons have been measured at deuteron bombarding energies of 16 and 79 MeV. The results are compared with Faddeev calculations using both separable (at 16 and 79 MeV) and local (at 79 MeV) interactions. These calculations include nucleon-nucleon forces in the S, P, and D states and the $^3S_1$-$^3D_1$ tensor force.

12290 **Low-energy nuclear reactions with hydrogen isotopes.** Jarmie, N.; Brown, R.E. (Los Alamos National Lab., NM, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 405-410(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as report LA-UR--84-3349; CONF-841117--15.

Using the Los Alamos Low-Energy Fusion Cross-Section Facility (LEFCS), we have completed the study of the D(t,α)n reaction from Esub(t) = 12.5 - 117 keV, and now have measured angular distributions of the reactions D(d,p)T and D(d,^{3}He)n from Esub(d) = 20 - 117 keV. The experimental equipment features of windowless cryogenic target, a precision beam-intensity calorimeter, a 10 to 120 keV accelerator producing negative tritium ions, an accurate target gas-flow and temperature system, and a tritium gas-handling system. Most of the quite anisotropic angular distributions of the D+D reactions have relative errors of about 1% and the integrated cross-sections have absolute errors of about 1.5%. Astrophysical S functions extracted from the data and also from a least-sqares fit of a+b cos^{2}theta to the data show a curious behavior with energy. The cross-sections, which agree with previous but less accurate data, are compared with R-matrix calculations. We also show preliminary results for alpha-particle spectra of the T(t,α)nn reaction. A feature of this experiment is the flow through our windowless target of 1.5 standard liters of tritium gas per day.

12291 **Measurement and application of DDsub(γ), DTsub(γ) and D^{3}Hesub(γ) reactions at low energy.** Cecil, F.E.; Cole, D.M.; Wilkinson, F.J. III; Medley, S.S. (Colorado School of Mines, Golden, USA. Dept. of Physics; Princeton Univ., NJ, USA. Plasma Physics Lab.). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 411-414(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

The gamma ray branching ratios for the reactions T(d,γ)^{5}He, D(d,γ)^{4}He, ^{3}He(d,γ)^{5}Li have been measured between center of mass energies of 25 to 100 keV. The branching ratios are observed to be roughly constant over the energy range of the measurements with best values Γsub(dtγ) / Γsub(dtα) = (5.4 +- 1.3) x 10^5 Γsub(ddγ) / Γsub(ddp) = (1.1 +- 0.3) x 10^7 and Γsub(d3Heγ) / Γsub(d3Heα) = (5.0 +- 1.2) x 10^5. These branching ratios are used to calculate the reactivities for the production of the gamma rays by high temperature plasmas. Specific applications to TFTR plasmas will be presented.

12292 Structure of the $^3H \rightarrow n + d(d^*)$ vertexes. Gibson, B.F.; Lehman, D.R. (Los Alamos National Lab., NM, USA; George Washington Univ., Washington, DC, USA. Dept. of Physics). pp 447-448 of Few body problems in physics. Volume II, contributed papers. Zeitnitz, B. Amsterdam, Netherlands; North-Holland (1984). (CONF-830862—Vol.2).

From 10. international conference on few-body problems in physics; Karlsruhe, F.R. Germany (21 Aug 1983).

The $^3H \rightarrow n + d(d^*)$ vertexes are key quantities in the interpretation of $^3He(e,e'p)d$, $^3He(p,2p)d$, $^3He(p,2p)d^*$, and similar experiments. Here, sets of ^3H wave functions derived from separable NN interactions ($^1S_0$ and $^3S_1$-$^3D_1$) were used to carry out a systematic analysis of the vertexes.

12293 Quasi-free scattering of πi and π from ^{3}He and ^{4}He at energies from 350 to 475 MeV. Minehart, R.C.; Boswell, J.; Gugelot, P.C.; Kaelline, J.; McCarthy, J.; Orphanos, L.; Smith, C.; Whitney, R.R.; Gram, P.A.M. (Virginia Univ., Charlottesville, USA. Dept. of Physics; Los Alamos National Lab., NM, USA). pp 231-232 of Few body problems in physics. Volume II, contributed papers. Zeitnitz, B. Amsterdam, Netherlands; North-Holland (1984). (CONF-830862—Vol.2).

From 10. international conference on few-body problems in physics; Karlsruhe, F.R. Germany (21 Aug 1983).

The authors have measured quasi-free scattering of positive and negative pions from ^{3}He and ^{4}He at incident energies of 350, 400 and 475 MeV. Measurements were made for angles of 60°, 90°, and 120° with the spectrometer set for several momentum settings at each angle to cover the region of the QFS peak.

6513 Nuclear Properties And Reactions, A=6-19, Theoretical

12294 (CEA-CONF—7800) Measurement of cross sections of total nuclear photon absorption by the ^{12}C and ^{208}Pb nuclei in the Δ(1232) region. Ghedira, M.L.; Audit, G.; de Botton, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1985. 6p. (In French). (CONF-8502101—5; DPh-N—2242bis). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750357.

From 8. biennial session on nuclear physics; Aussois, France (4 Feb 1985).

The photon total absorption cross-section has been measured using an positron annihilation in flight tagged photon beam and a very large acceptance 4π detector (with an overall efficiency of the order of 85%) in the energy range 133-531 MeV on carbone and lead. The measured cross-section varies linearly with A and is compared to other experiments and theoretical predictions.

12295 (CERN-EP—85-168) Direct photon production from pions and protons at 200 GeV/c. Bardadin-Otwinowska, M. (European Organization for Nuclear Research, Geneva (Switzerland); Clermont-Ferrand-1 Univ., 63 - Aubiere (France)). 11 Oct 1985. 8p. (CONF-850785—7). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900399.

From 5. international conference on physics in collision; Autun, France (3 Jul 1985).

Final results are presented on the production of the direct photons by positive and negative beams of 200 GeV/c momentum interacting with an isoscalar Carbon target. Inclusive cross sections are reported for the direct photons and π^0's of transverse momentum 3 < p/sub T/ < 6 GeV/c and rapidity -0.4 < y < 1.2. The photon data are compared with the predictions of a second order QCD calculation. Gluon structure function of the proton is estimated. A signal of double photons, when each of them has transverse momentum >1.8 GeV/c, is observed. 10 refs., 4 figs., 2 tabs.

12296 (DOE/ER/05224—9) Research in experimental nuclear physics. Progress report, 1 April 1985-31 March 1986. (Texas Univ., Austin (USA)). Nov 1985. Contract AS05-76ER05224. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86000864.

An overview of experiments performed at LAMPF on the Energetic Pion Channel and Spectrometer (EPICS) or at the High Resolution Spectrometer (HRS) is presented. A list of abstracts of papers reported at scientific meetings and a list of published papers is given. (WRF)

12297 (DOE/ER/10714—5) Research in nuclear physics. Progress report, April 1, 1985-March 31, 1986. Mateja, J.F. (Tennessee Technological Univ., Cookeville (USA). Dept. of Physics). 1985. Contract AS05-80ER10714. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004691.

A review of research in progress for heavy ion and heavy ion fusion reactions is given. In addition preliminary results of calculations critical angular momentum associated with fusion are presented. 6 refs., 4 figs., (WRF)

12298 (IFUSP-P—451) sup(10,11) B(p, n) sup(10,11) C reaction between E sub(p) = 13.6 and 14.7 MeV. Schelin, H.R.; Wylie, W.R.; Cardoso Junior, J.L.; Pessoa, E.F.; Douglas, R.A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jan 1984. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700433.

Absolute differential cross sections for the n_0 and n_1 neutron groups for the reaction $^{10}B(p, n)^{10}C$ and the n_0, n_1, n_2, n_3, $n_4 + n_5$, n_6 and n_7 neutron groups for the reaction $^{11}B(p, n)^{11}C$ have been measured at incident proton energies of 14.0, 14.3 and 14.6 MeV in the angular interval 20° to 160° along with excitation curves at theta sub(lab) = 30° from Esub(p) = 13.6 to 14.7 MeV.

12299 (IFUSP-P—460) Study on particle emission in the light-heavy ion fusion reactions: ^{14}N, sup(16,18) O + ^{12}C. Carlin Filho, N.; Coimbra, M.M.; Acquadro, J.C.; Liguori Neto, R.; Szanto, E.M.; Pessoa, E.F.; Toledo, A.S. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1984. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700440.

From the energy spectra of light particles produced in light heavy ion induced reactions, level densities of the final nuclei as well as the critical angular momenta for fusion may be obtained. The ^{14}N, sup(16,18) O + ^{12}C reactions were investigated in the energy range 30 MeV < Esub(LAB) < 60 MeV. Detailed angular distributions of the light particles (p, d, t, α) emitted in the process were obtained. Fits of the magnitude and shape of the spectra, by means of statistical model calculations were used to extract final nuclei level densities. The shape of the spectra and the ratio $\sigma(\alpha)$ $\sigma(p)$ are shown to be sensitive to the fusion critical angular momentum (J sub(cr)), offering an alternative method for the total fusion cross-section determination.

12300 (IFUSP-P—472) Description of antiproton-nucleus scattering with the proton-nucleus Dirac impulse approximation optical potential. Hussein, M.S.; Carlson, B.V.; Isidro Filho, M.P. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700421.

The antiproton-nucleus scattering problem is formulated as the charge-conjugated Dirac equation for proton-nucleus scattering. The Dirac impulse approximation optical potential is used to calculate within the eikonal approximation the scattering observables for p sup(-) + ^{12}C, p sup(-) + ^{27}Al and p sup(-) + ^{63}Cu in the beam momentum range 400-1000 MeV/C. Good agreement with the data is obtained.

12301 (IFUSP-P—487) Back-angle scattering of antiprotons from nuclei. Hussein, M.S.; Carlson, B.V.; Isidro Filho, M.P. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700424.

The large-angle, elastic scattering of antiprotons from ^{12}C is calculated in the center-of-mass kinetic energy range 100 < T < 400 MeV. The optical model is constructed by adding a folded annihilation potential to the central G-parity transformed p+^{12}C impulse approximation Dirac optical potential. It is found that the annihilation potential affects the scattering mainly in backward hemisphere. Large back-angle cross sections are predicted. The 180°-ex-

citation is found to exhibit resonance-like energy oscillation with a 25-45 MeV period. Negligible spin polarization is found in the whole angular range.

12302 **(ISN—83-54) Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon.** Kox, S.; Gamp, A.; Cherkaoui, R.; Cole, A.J.; Longequeue, N.; Menet, J.; Perrin, C.; Viano, J.B. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Sep 1984. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86750048.

Measurements of σsub(R) have been performed at 30 and 83 MeV/nucleon incident energy for 15 heavy ion systems using the attenuation method. The data are compared with predictions of microscopic calculations and a semi empirical formula is given for σsub(R).

12303 **(JINR—E-4-84-618) Radiative muon capture on ^{16}O.** Christillin, P.; Gmitro, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700435.

Predictions of the photon spectrum of radiative muon capture on ^{16}O are given within a phenomenological approach for a realistic nuclear excitation spectrum which includes low-lying excited states. Preliminary experimental results are totally at variance with the predictions based on the canonical value of the induced pseudoscalar coupling constant gsub(P).

12304 **(TRI-PP—85-6) Angular dependence of the sup(6)Li(πsup(+), sup(3)He)sup(3)He reaction.** McParland, B.J.; Auld, E.G.; Couvert, P. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1985. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700436.

Angular distributions of the differential cross sections for the pionic fission sup(6)Li(πsup(+), sup(3)He)sup(3)He have been measured at pion energies of 60 and 80 MeV. The differential cross section is found to decrease monotonically with cossup(2)thetasup(*) and is compared with a theoretical prediction.

12305 **(TRI-PP—85-9) Polarized proton induced pion production on ^{10}B at 200, 225, 250 and 260 MeV incident energies.** Ziegler, W.; Auld, E.G.; Falk, W.R.; Giles, G.L.; Jones, G.; Lolos, G.J.; McParland, B.; Walden, P.L.; Ottewell, D.F. (TRIUMF, Vancouver, British Columbia (Canada)). Feb 1985. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700437.

The angular distributions of both the differential cross-section and the analyzing power are presented for the ^{10}B(p,π)^{11}B reaction leading to the ground and first excited states of ^{11}B. The differential cross-section shows very little angular structure or energy dependence, but the analyzing power exhibits a considerable energy dependence for both states. This dependence, similar to that observed for the ^{13}C(p,π^+)^{13}C reaction, may be a signature of the fact that single-particle final states are involved.

12306 **Time-dependent Dirac equation with relativistic mean-field dynamics applied to heavy-ion scattering.** Cusson, R.Y.; Reinhard, P.G.; Molitoris, J.J.; Stoecker, H.; Strayer, M.R.; Greiner, W. (Gesellschaft fur Schwerionenforschung, Darmstadt, Federal Republic of Germany; Department of Physics, Duke University, Durham, North Carolina 27706). *Physical Review Letters;* **55**: No. 25, 2786-2789(16 Dec 1985). Contract AC05-84OR21400;AS05-83ER40101.

We treat the relativistic propagation of nucleons coupled to scalar- and vector-meson fields in a mean-field approximation. The time-dependent Dirac and mean—meson-field equations are solved numerically in three dimensions. Collisions of ^{16}O (300, 600, and 1200 MeV/nucleon) + ^{16}O are studied for various impact parameters. The results are compared to other recent theoretical approaches. The calculations predict spallation, large transverse-momentum transfer, and positive-angle sidewards flow, in qualitative agreement with the data in this energy regime.

12307 **Measurements of interaction cross sections and nuclear radii in the light p-shell region.** Tanihata, I.; Hamagaki, H.; Hashimoto, O.; Shida, Y.; Yoshikawa, N.; Sugimoto, K.; Yamakawa, O.; Kobayashi, T.; Takahashi, N. (Institute for Nuclear Study, University of Tokyo, Tanashi, Tokyo 188, Japan). *Physical Review Letters;* **55**: No. 24, 2676-2679(9 Dec 1985). Contract AC03-76SF00098.

Interaction cross sections (σ/sub I/) for all the known Li isotopes (^{6}Li—^{11}Li) and ^{7}Be, ^{9}Be, and ^{10}Be on targets Be, C, and Al have been measured at 790 MeV/nucleon. Root mean square radii of these isotopes as well as He isotopes have been deduced from the σ/sub I/ by a Glauber-type calculation. Appreciable differences of radii among isobars (^{6}He-^{6}Li, ^{8}He-^{8}Li, and ^{9}Li-^{9}Be) have been observed for the first time. The nucleus ^{11}Li showed a remarkably large radius suggesting a large deformation or a long tail in the matter distribution.

12308 **Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target.** Shapira, D.; Gomez del Campo, J.; Ford, J.L.C. Jr.; Shivakumar, B.; Stelson, P.H.; Harmon, B.A.; Parks, R.L.; Thornton, S.T. (Oak Ridge National Lab., TN, USA; Virginia Univ., Charlottesville, USA. Dept. of Physics). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 436-440(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117–41.

A study of target-like fragments produced by bombarding a ^{14}N target with 150 MeV ^{28}Si shows that mass and charge distribution of products from orbiting processes is determined by partitioning of an equilibrated dinuclear system. The experiment was performed with the HHIRF supersonic gas jet target which is also described briefly.

12309 **A reevaluation of the ^{9}Be(n,2n) reaction and its effect on neutron multiplication in fusion blanket applications.** Perkins, S.T.; Howerton, R.J.; Plechaty, E.F. (Lawrence Livermore National Laboratory, Livermore, California). *Nuclear Science and Engineering;* **90**: No. 1, 83-98(May 1985).

Using a Monte Carlo technique and recent double-differential measurements, a reevaluation of the ^{9}Be(n,2n) reaction has been completed. This evaluation is currently available for use in the most recent evaluation of the Evaluated Nuclear Data Library and will be used in ENDF/B-VI. Calculations have been carried out with these data, and implications for neutron multiplication in beryllium fusion reactor blankets are discussed.

6514 Nuclear Properties And Reactions, A=20-38, Theoretical

REFER ALSO TO CITATION(S) 12300, 12314

12310 **(ANU-P—904) Masses and level schemes of ^{33}Si and ^{34}Si.** Fifield, L.K.; Wooda, C.L.; Bark, R.A.; Drumm, P.V.; Hotchkis, M.A.C. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Feb 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700438.

The mass excesses of ^{33}Si and ^{34}Si have been measured using the ^{30}S(^{11}B,^{14}N)^{33}Si and ^{30}S(^{11}B,^{13}N)^{34}Si reactions. Values of -20.550 +- 0.030 MeV (^{33}Si) and -20.017 +- 0.025 MeV (^{34}Si) were obtained. In addition, an excited state of ^{34}Si was observed at 5.33 +- 0.05 MeV, and excited levels of ^{33}Si were observed at 1.06 +- 0.02 and 4.32 +- 0.03 MeV. These results are compared with recent shell model calculations.

12311 **(ANU-P—908) Ground state mass excesses and low lying levels of the neutron rich nuclei ^{36}P, ^{35}P and ^{34}P.** Drumm, P.V.; Fifield, L.K.; Bark, R.A.; Hotchkis, M.A.C.; Woods, C.L.; Maier-Komor, P. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Mar 1985. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700439.

The ground state masses and the excitation energies of low lying levels of the nuclei ^{36}P, ^{35}P and ^{34}P have been measured using the ^{36}S(^{7}Li,^{7}Be)^{36}P and ^{34}S(^{7}Li,^{7}Be)^{34}P charge exchange reactions, and the one nucleon transfer reaction ^{36}S(^{6}Li,^{7}Be)^{35}P. Mass excess values of -20.251 +- 0.027 MeV (^{36}P), -24.828 +- 0.017 MeV (^{35}P), and -24.569 +- 0.040 MeV (^{34}P) were obtained. A single excited state is observed at 252 +- 10 keV in ^{35}P, and a number of new levels are observed in the nuclei ^{35}P and ^{34}P. The ^{36}S(^{11}B,^{11}C)^{36}P and ^{34}S(^{11}B,^{11}C)^{34}P reactions were also studied in order to remove ambiguities associated with the 429 keV level in ^{7}Be.

12312 (CRN-PN—84-37) Fission-like phenomena for systems with mass A=110. Heusch, B. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1984. 16p. (CONF-8409250—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750046.

From International symposium on heavy ion fusion reactions; Tsukuba, Japan (3 Sep 1984).

We present a part of the considerable amount of data we obtained these last years in the study of composite systems of mass around 110. From the rotating liquid drop models, theses systems are known as nearly the most stable nuclei, i.e. angular momenta as large as 90 h can be fully absorbed. Only bombarding energies less than 8 MeV/nucleon will be considered here avoiding therefore that imcomplete fusion, projectile fragmentation of other such mechanisms play a measurable role.

12313 (IFUSP-P—459) Use of energy-averaged cross sections for nuclear spectroscopy: ^{26}Mg states in the continuum. Coimbra, M.M.; Carlin Filho, N.; Toledo, A.S. de; Stwertka, P.M.; Herman, M.G.; Nicolas, N.G.; Cormier, T.M. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700434.

Energy averaged cross sections for the ^{12}C(^{18}O,α)^{26}Mg reaction were studied. Over 80 states between Esub(x) (^{26}Mg) = 5 and 20 MeV were observed for many bombarding energies in the range E(^{18}O) = 46 to 50 MeV. Broad, non-correlated structures observed in the excitation functions prevent the application of Hauser-Feshbach analysis for spin spectroscopy to this particular data set. By implication, these results cast doubt on the previously suggested backbend in the ^{26}Mg Yrast sequence.

12314 (IFUSP-P—461) ^{24}Mg yrast sequence up to 30 MeV excitation. Toledo, A.S. de; Cormier, T.M.; Coimbra, M.M.; Carlin Filho, N.; Stwertka, P.M.; Nicolis, N.G. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700441.

Highly excited states observed in the ^{12}C(^{16}O,α)^{24}Mg reaction are analyzed within the statistical model. Evidence that the E* = 28.21 MeV, 33.34 MeV, and 38.22 MeV states correspond to high spin states is found. The ^{24}Mg yrast line can be identified up to the 12^{+} state located at 28.21 MeV excitation energy.

12315 (IFUSP-P—506) Effects of the dynamic α-transfer polarization potential in the large-angle scattering of ^{16}O+^{28}Si. Hussein, M.S.; Aleixo, A.N.F.; Canto, L.F.; Carrilho, P.; Donangelo, R.J. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700426.

The trivially equivalent local α-transfer polarization potential for the process ^{16}O+^{28}Si $\rightarrow$ ^{12}C+^{32}S $\rightarrow$ ^{16}O+^{28}Si is evaluated. The back-angle elastic scattering angular distributions of ^{16}O+^{28}Si at several center of mass energies obtained with the polarization potential added to the E-18 interaction were found to be in good agreement with the data, if an α-transfer spectroscopic factor of 0,4 is used.

6515 Nuclear Properties And Reactions, A=39-58, Theoretical

12316 (CEA-CONF—7796) Do collective effects exist in the intra-nuclear cascade. L'hote, D.; Cugnon, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1985. 11p. (In French). (CONF-8502101—3; DPh-N-S—2226). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750355.

From 8. biennial session on nuclear physics; Aussois, France (4 Feb 1985).

The results of the "Boule Plastique" (detector 4π) concerning the collisions ^{40}Ca + ^{40}Ca et ^{93}Nb + ^{93}Nb are presented. One deals more particularly with the distribution of the flow angle theta for several multiplicity intervals in the case of the collisions Ca + Ca and Nb + Nb and for an intranuclear cascade calculation. Experimental results can be compared to the theoretical calculations only if an experimental filters is applied to the theoretical calculations. One studies how the "collective flow", characterized by the fact that the nucleons receive preferentially a transfer in the reaction plane and in the sense of the impact parameter, is traduced in the distributions dN/d cos theta. The results of the calculations of the tripling differential cross section are presented. Other theoretical models are finally briefly evoked.

12317 (CENBG—8429) Measurement of the ionization probability of the 1s sigma molecular orbital in half a collision at zero impact parameter. Chemin, J.F.; Andriamonje, S.; Guezet, D.; Thibaud, J.P.; Aguer, P.; Hannachi, F.; Bruandet, J.F. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). 1984. 5p. (CONF-840788—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750349.

From International conference on the physics of highly ionized atoms; Oxford, UK (2 Jul 1984).

We have measured, for the first time, the ionization probability Psub(1s sigma) of the 1s sigma molecular orbital in the way into a nuclear reaction (in half a collision at zero impact parameter) in a near symmetric collision ^{58}Ni + ^{54}Fe at 230 MeV leads to a compound nucleus of ^{112}Xe highly excited which decays first by sequential emission of charged particles and then by sequential emission of gamma rays. The determination of Psub(1s sigma) is based on the coincidence measurement between X-rays and γ-rays and the Doppler shift method is used to discrimine the "atomic" and "nuclear" X-rays.

12318 (IFUSP-P—464) Intermediate energy nucleon-nucleus total reaction cross section in the Dirac phenomenology. Carlson, B.V.; Isidro Filho, M.P.; Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700418.

The total reaction cross section for intermediate energy nucleon-nucleus scattering systems is calculated within the Dirac-eikonal formalism. Comparison with data indicates that the recently proposed impulse-approximation Dirac optical potential for nucleon-nucleus scattering, is not absorptive enough.

12319 (IFUSP-P—465) Reactive content of the proton-nucleus impulse - approximation Dirac optical potential. Carlson, B.V.; Isidro Filho, M.P.; Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700419.

The total reaction cross sections for intermediate energy proton scattering on ^{40}Ca and ^{208}Pb are calculated within the Dirac-Eikonal formalism. Comparison with data indicate that the recently proposed impulse-approximation Dirac optical potential for nucleon-nucleus scattering, is not absorptive enough.

12320 (IFUSP-P—473) Near/far decomposition of the proton-nucleus and antiproton-nucleus elastic scattering angular distributions. Carlson, B.V.; Isidro Filho, M.P.; Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700422.

The elastic scattering of protons and antiprotons from nuclei at intermediate energies is discussed using the near-side/far-side decomposition of the Dirac eikonal amplitude. It is suggested that, whereas the p + A scattering system is predominantly absorptive, the p sup(-) + A system exhibits strong refractive effects, leading to a far-side dominance in the angular distributions. Applications are made to several systems.

12321 **Mass dependence of shell effects at high rotational frequencies.** Macchiavelli, A.O.; Muehry, H.; Deleplanque, M.A.; Diamond, R.M.; Stephens, F.S.; Dines, E.L.; Draper, J.E. (Lawrence Berkeley Lab., CA, USA. Nuclear Science Div.). *Nuclear Physics [Section] A;* **443**: No. 3, 538-556(7 Oct 1985).

The continuum γ-ray spectra from the reactions ^{40}Ar(170-185 MeV) + ^{92}Ti, ^{68}Zn, ^{82}Se, ^{100}Mo -> ^{80}Zrsup(*), ^{108}Cdsup(*), ^{122}Tesup(*), ^{140}Ndsup(*), respectively have been studied by using a sum-energy technique. The evolution of the γ-ray spectra with sum energy (spin) suggests the presence of rotational motion at high spins. A method to correct for incomplete feeling was applied to the γ-ray spectra and effective moments of inertia were determined. The results indicate the appearance of a new source of angular momentum at high rotational frequencies. We interpret this as the alignment of high-j orbitals from the next major shell. Simple arguments, as well as cranked-shell-model calculations are consistent with this picture. Data on band moments of inertia, from Esub(γ)-Esub(γ) correlation experiments, are also in accord with our interpretation.

12322 **Resonance neutron capture by manganese below 2.5 keV.** Macklin, R.L. (Oak Ridge National Laboratory, Oak Ridge, Tennessee). *Nuclear Science and Engineering;* **89**: No. 4, 362-365(Apr 1985).

Radiation widths Γ /sub gamma/ of (310 + or - 20), (312 + or - 12), and (340 + or - 130) MeV were found for ^{55}Mn(n,√) resonances at 337, 109, and 2327 eV, respectively. A fourth resonance was found at 1658 eV, with gΓ /sub n/ Γ /sub mk/ / Γ = (7.6 + or - 0.3) MeV.

6516 Nuclear Properties And Reactions, A=59-89, Theoretical

REFER ALSO TO CITATION(S) 12300

12323 **(AERE-R—11439) Neutron scattering and reactions on 59Co from 1 to 20 MeV.** Wilmore, D.; Hodgson, P.E. (UKAEA Atomic Energy Research Establishment, Harwell). Jan 1985. 36p. Issuing Activity.

The aim was to make a complete analysis of all the interactions of neutrons with 59Co in the energy range 1-20 MeV, excluding the resonance region at very low energies. In this energy region the interactions change in character and this is reflected in the cross-sections and in the methods used to analyze them. At low energies the compound nucleus mechanism dominates, and the corresponding on-elastic cross-sections may be evaluated using the Hauser-Feshbach formalism. The elastic, total and absorption cross-sections are evaluated using the optical model, which also provides the potentials used in the Hauser-Feshbach calculations. At higher energies there are increasing contributions from direct reactions, and from multistep processes. The overall energy variations of the total cross-sections of the competing reactions are given. The most important non-elastic process is neutron inelastic scattering, which includes (n,2n) reactions, and there are smaller contributions from the (n,p) and (n,alpha) reactions. At higher energies, several reactions like (n,np) and (n,n alpha) involving the emission of two particles become energetically possible.

12324 **(JINR—R-7-84-358) Observation of a long-lived nuclear quasimolecule in the ^{20}Ne + Ge system.** Karamyan, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1984. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700442.

Submitted to the journal JETP Lett. .

Germanium single crystal was irradiated by 102 MeV ^{20}Ne ions. For the nuclei, recoiled in elastic and inelastic nuclear interaction, blocking effect minima are fixed at the angular distribution. The minima have almost disappeared for the target-like product emission angles THETA=58-52 deg relative to the beam. Corresponding duration time of the reaction is about 10^{-17} s.

12325 **The LBL/UCSB ^{76}Ge double beta decay experiment: first results.** Goulding, F.S.; Cork, C.P.; Eisberg, R.M.; Grumm, D.M.; Hald, D.L.; Landis, D.A.; Luke, O.N.; Madden, N.W.; Malone, D.F.; Witherell, M.S. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 1, 462-470(Feb 1985). (CONF-841007—).

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

A paper given at the IEEE Nuclear Science Symposium last year presented the scientific justification for this experiment and discussed the design of the detector system. At the present time two of the dual detector systems (i.e., four out of a final total of eight detectors) are operating in the complete active/passive shield in the low background laboratory at LBL. Early results (1620 hrs) of an experiment using two detectors yield a limit of 4 x 10^{23} years (68% confidence) for the half life of the neutrinoless double beta decay (ββ /sub o/ ν) of ^{76}Ge. Although this experiment was carried out above ground, the result approaches those achieved by other groups in deep underground laboratories. Based on studies of the origins of background in our system, we hope to reach a limit of 3 x 10^{25} years (or more) in a two month/four detector experiment to be carried out soon in an underground facility.

6517 Nuclear Properties And Reactions, A=90-149, Theoretical

12326 **(ANU-P—926) Octupole vibrational states in the even-mass barium isotopes.** Burnett, S.M.; Baxter, A.M.; Hinds, S.; Pribac, F.; Smith, R.; Spear, R.H.; Fewell, M.P. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Mar 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700443.

A low-lying state of ^{132}Ba, ^{134}Ba, ^{136}Ba and ^{138}Ba, strongly excited in the scattering of 20 MeV α particles at 175 deg, is identified as the first 3^- octupole vibrational state in each case. Angular distribution measurements for α particle scattering to this state and the well known first 2^+ state in ^{132}Ba, ^{134}Ba, ^{136}Ba and ^{138}Ba are in agreement with harmonic-vibration coupled-channels predictions. Deformation parameters are obtained, and the deduced isoscalar transition rates are compared with measured electromagnetic transition rates. The first 3^- states of ^{132}Ba, ^{134}Ba, ^{136}Ba and ^{138}Ba are found to be at excitation energies of 2.070, 2.251, 2.529 and 2.879 MeV respectively. A state in ^{130}Ba at an excitation energy of 1.948 MeV is tentatively identified as the first octupole-vibrational state in this nucleus.

12327 **(BNL—37162) Magnetic moments of excited states in nuclei far from stability.** Wolf, A.; Berant, Z.; Gill, R.L.; Warner, D.D.; Hill, J.C.; Wohn, F.K.; Menzen, G.; Sistemich, K. (Brookhaven National Lab., Upton, NY (USA); Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev; Ames Lab., IA (USA); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). 1985. Contract AC02-76CH00016. 7p. (CONF-850942—42). NTIS, PC A02/MF A01; GPO Dep. File Number DE86003381.

From 190. American Chemical Society national meeting; Chicago, IL, USA (8 Sep 1985).

Magnetic moments of excited states in nuclei far from stability have been measured by gamma-gamma angular correlation at the output of the fission product separators TRISTAN and JOSEF. The results obtained until now will be reviewed. They provide important nuclear structure information about nuclei around closed shells, and transitional nuclei in the A = 100 and 150 regions. 22 refs., 3 figs., 3 tabs.

12328 (CEA-CONF—7509) Quadrupole boson densities in the germanium region by inelastic electron scattering. Goutte, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1984. 20p. (CONF-8408173—1; DPh-N-S—2194). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750362.

From International workshop on interacting boson-boson and boson-fermion systems; Gull Lake, MI, USA (28 Aug 1984).

The collective properties of four germanium isotopes have been explored through the measurement of the transition charge densities of the first two 2^+ states. Their spatial features and their apparent anomalous behavior is readily explained in the frame of the Interacting Boson Model.

12329 (EGG-PHY—7086) Report on CFRMF fission product loop study. Gupta, V.P.; Baker, J.D.; Meikrantz, D.H.; Harker, Y.D.; Napper, P.R.; Heath, R.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1985. Contract AC07-76ID01570. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005317.

An experimental study of tellurium plateout on stainless steel, using a fission product loop, was performed. The gamma-rays from tellurium and daughter iodine were analyzed. Analysis showed that both Te and I isotopes decayed with half-lives close to published values. The initial conclusion is that Te decay following plate-out does not provide a significant release mechanism for the respective I daughter isotopes. 11 refs., 15 figs., 4 tabs.

12330 (JINR—R-4-84-203) Possibility of excitation twist mode selection in the (e, e') reaction. Ponomarev, V.Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700429.

Submitted to the journal J. Phys., G Nucl. Phys.

The contribution of the convection and spin components of 2^--state current transition density to the (e, e') reaction cross section at momentum transferred qsub(eff) from 0 to 2.5 Fm^{-1} is analysed in the DWBA for ^{90}Zr and ^{208}Pb. It is found that the convection component gives the main contribution to the cross section in the region of qsub(eff)=0.8 Fm^{-1} for ^{90}Zr and qsub(eff)=0.6 Fm^{-1} in ^{208}Pb. It is concluded that the fragments of the "nuclear twist" formed by the convection component were detected in Darmstadt in the (e, e') ^{208}Pb reaction.

12331 (LUNFD6/NFFR—3055/1-26(1985)) Neutron-capture cross-section measurements for ^{115}In and ^{197}Au in the energy region 2.0-7.7 MeV, using the activation technique. Andersson, P.; Zorro, R.; Bergqvist, I. (Lund Univ. (Sweden). Dept. of Physics). 1985. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700445.

The cross sections for the reactions $^{115}In(n,\gamma)^{115sup(m)}In$ and $^{197}Au(n,\gamma)^{198}Au$ have been measured with the activation method in the energy range 2.0-7.7 MeV. The influence of background neutrons on the results has been studied in considerable detail. The main problems in the measurements are caused by low-energy neutrons generated by charged-particle reactions (e.g. (p,n) and (d,n) reactions) in the target material and by secondary neutrons (primarily (n,n') reactions) from the sample and surrounding materials. Low-mass target-sample assemblies have been constructed and methods to correct for the background neutrons have been developed.

12332 Deformation and shape coexistence in medium mass nuclei. Meyer, R.A. (Lawrence Livermore National Lab., CA, USA). *Hyperfine Interactions;* 22: No. 1-4, 385-403(Mar-May 1985). (CONF-8408123—).

From International symposium on nuclear orientation and nuclei far from stability; Leuven, Belgium (28 Aug 1984).

Emerging evidence for deformed structures in medium mass nuclei is reviewed. Included in this review are both nuclei that are ground state symmetric rotors and vibrational nuclei where there are deformed structures at excited energies (shape coexistence). For the first time, Nilsson configurations in odd-odd nuclei within the region of deformation are identified. Shape coexistence in nuclei about the medium mass region of deformation is also examined. Recent establishment of a four-particle, four-hole intruder band in the double subshell closure nucleus $^{90}Zr_{56}$ is presented and its relation to the nuclear vibron model is discussed. Special attention is given to the N=59 nuclei where new data have led to the reanalysis of ^{97}Sr and ^{99}Zr and the presence of the [404 9/2] hole intruder state as isomers in these nuclei. The low energy levels of the N=59 nuclei from Z=38 to 50 are compared with recent quadrupole-phonon model calculations that can describe their transition from near-rotational to single closed shell nuclei. The odd-odd N=59 nuclei are discussed in the context of coexisting shape isomers based on the (p[303 5/2]n[404 9/2])2 configuration. Ongoing in-beam (t,p conversion-electron) multiparameter measurements that have led to the determination of monopole matrix elements for even-even $_{42}Mo$ nuclei are presented, and these are compared with initial estimates using IBA-2 calculations that allow mixing of normal and cross subshell excitations. Lastly, evidence for the neutron-proton $^3S_1$ force's influence on the level structure of these nuclei is discussed within the context of recent quadrupole-phonon model calculations.

6518 Nuclear Properties And Reactions, A=150-189, Theoretical

REFER ALSO TO CITATION(S) 12327, 12338

12333 (ANU-P—909) Atomic L-subshell yields from the electron capture decays of $_{65}157Tb$ and $_{65}158Tb$. Dincklage, R.-D. von; Hay, H.J. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Feb 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700446.

Sources of the mass and separated terbium isotopes, A=157 and 158, have been used to study inner shell phenomena at Z=64. In coincidence experiments employing high resolution Ge and Si(Li) detectors, photon spectra characteristic of 2s, 2psub(1/2), and 2psub(3/2) vacancies have been measured. The following results were obtained: $f_{12}=0.20$ +- 0.03, $f_{13}=0.289$ +- 0.015, $f_{23}=0.14$ +- 0.02, $\nu_1=0.179$ +- 0.014, $\nu_2=0.21$ +- 0.02, $\omega_3=0.183$ +- 0.015. From this $\omega_1=0.084$ +- 0.016 and $\omega_2=0.185$ +- 0.020 were deduced. Generally good agreement with the calculations is found, while larger discrepancies pertain to an overall fit of previous experimental results. The electron capture decay energy of ^{157}Tb was inferred from the measured 2s- fluorescence yield to be 62.2 +- 0.6 keV.

12334 (IFUSP-P—504) Photoneutron cross sections. Wolynec, E.; Serrao, V.A.; Gouffon, P.; Miyao, Y.; Martins, M.N. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700447.

The differences between the Saclay and Livermore photoneutron cross sections are discussed. It is shown that the differences between their (γ,n) and (γ,2n) cross sections arise from the neutron multiplicity sorting. Measurements of the (e,n) and (e,2n) cross sections in ^{181}Ta show that Livermore has the correct multiplicity sorting.

12335 (JINR—R-3-85-74) Correlation between the partial cross sections for the $^{174}Yb(n,2\gamma)^{176}Yb$ and $^{176}Yb(d,t)^{176}Yb$ reactions. Popov, Yu.P.; Sukhovoj, A.M.; Khitrov, V.A.; Yazvitskij, Yu.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1985. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700448.

Submitted to the journal Sov. J. Nucl. Phys. .

Statistically unambigous correlation between two-quanta cascade intensities in the $^{174}Yb(n, 2\gamma)^{176}Yb$ reaction and spectroscopic factors for the $^{176}Yb(d,t)^{176}Yb$ reaction has been observed. The obtained results are an experimental indication to a significant role of hole quasiparticle components of the wave functions for ^{176}Yb excited states in the process of γ decay of this compound nucleus.

12336 **(JINR—R-4-85-16) Nonrotational states in ^{165}Er.** Bonch-Osmolovskaya, N.A.; Morozov, V.A.; Nesterenko, V.O. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1985. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700411.

Submitted to the journal Bull. Acad. Sci. USSR.

Using the available experimental data and the calculations in the framework of the quasiparticle-phonon model the analysis of excited states in ^{165}Er has been performed. β-vibrational components of the states are included into the calculations. The pauli principle is taken into account.

12337 **(JINR—R-4-85-45) Fragmentation of subshells in rare earth nuclei.** Nguen Din' Vin'. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1985. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700412.

Submitted to the journal Acad. Sci. USSR, Phys. Ser. .

The fragmentation of the neutron and proton spherical subshells in nuclei ^{151}Sm, ^{155}Gd, ^{171}Yb, ^{173}Lu is calculated within the quasiparticle-phonon nuclear model. The calculated one-particle strength distributions are in agreement with typical behaviour of the cross section of one-nucleon transfer reaction for this region of nuclei.

12338 **(JINR—R-7-85-31) Fast neutron emission in interaction of 9 MeV/nucleon ^{12}C and ^{20}Ne ions with ^{181}Ta nuclei.** Kozulin, Eh.M.; Blinov, M.V.; Kovalenko, S.S.; Mozhaev, A.N.; Borcha, K.; Penionzhkevich, Yu.Eh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1985. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700449.

Submitted to the journal Sov. J. Nucl. Phys. .

The energy spectra and angular distributions for neutrons emitted in the reactions ^{12}C/105 MeV/+ ^{181}Ta and ^{20}Ne/180 MeV/+ ^{181}Ta have been measured. The neutron energy was determined using the two methods simultaneously: the time-of-flight method and by recording the energy of recoil protons. The obtained experimental data allow one to draw the conclusion that both the equilibrium and preequilibrium components of neutron emission are present in each reaction. However the yields and the angular distributions of preequilibrium neutrons emitted in these reactions are noticeably different. By comparing the results of the present study with other data it is shown that preequilibrium neutron emission has a more isotropic distribution than that for protons in the case of the same input channel of the reaction. In addition some information has been obtained about the dependence of the preequilibrium neutron and proton yields on the projectile mass. The data are analyzed in terms of the statistical model for description of the emission of evaporated neutrons, as well as in terms of the "rotating hot spot" model and a moving source, for preequilibrium neutrons.

12339 **Slow and fast high-spin sequences in ^{158}Er.** Tjom, P.O.; Diamond, R.M.; Bacelar, J.C.; Beck, E.M.; Deleplanque, M.A.; Draper, J.E.; Stephens, F.S. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review Letters;* 55: No. 22, 2405-2408(25 Nov 1985). Contract AC03-76SF00098.

Two branches are observed feeding the 38^+ level of the yrast line in ^{158}Er. Two ~1.2-MeV cascade transitions constitute a fast (<1 ps) collective component, probably with only minor changes in shape and structure from those at lower spin. Four slower γ rays (>2 ps) suggest a transition to a different shape and structure, most likely to an oblate 46^+ state with all valence particles maximally aligned, a band termination.

6519 Nuclear Properties And Reactions, A=190-219, Theoretical

12340 **(ANU-P—905) Yrast spectroscopy of ^{209}Rn.** Poletti, A.R.; Dracoulis, G.D.; Fahlander, C.; Byrne, A.P. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Feb 1985. 49p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700450.

The yrast spectroscopy of ^{209}Rn has been investigated to an excitation energy of over 7 MeV and to a spin of 51/2 (h/2π). The existence of six isomers has been established: at 1174 keV (Jsup(π) = $13/2^+$, tau sub(m) = 19.3 +- 1.9 μs), 1687 keV ($19/2^-$, 1.0 +- 0.3 ns), 2419 keV ($21/2^+$, 12.6 +- 0.3 ns), 3158 keV ($29/2^-$, 20 +- 3 ns), 3637 keV ($35/2^+$, 4.3 +- 0.4 μs) and 4834 keV ($41/2^-$, 14.4 +- 0.5 ns). Shell model calculations are used to explain the observed structure. E3 and M2 transitions in ^{209}Rn and neighbouring nuclei are discussed.

12341 **(ANU-P—915) Magnetic moments, E3 transitions and the structure of high spin core excited states in ^{211}Rn.** Poletti, A.R.; Dracoulis, G.D.; Byrne, A.P.; Stuchbery, A.E.; Poletti, S.J.; Gerl, J.; Lewis, P.M. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Mar 1985. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700451.

The results of g-factor measurements of high spin states in ^{211}Rn are: Esub(x)=8856+Δsup(') keV (Jsup(π)=$63/2^-$), g=0.626(7); 6101+Δsup(') keV ($49/2^+$), 0.766(8); 5247+Δsup(') keV ($43/2^-$), 0.74(2); 3927+Δsup(') keV ($35/2^+$), 1/017(12); 1578+Δsup(') keV ($17/2^-$), 0.912(9). These results together with measured E3 transition strengths and shell model calculations are used to assign configurations to the core excited states in ^{211}Rn. Mixed configurations are required to explain the g-factors and enhanced E3 strengths simultaneously.

12342 **(CEA-CONF—7795) πi and π^- production in the α-nucleus and nucleus-nucleus collisions between 200 and 800 MeV/nucleon.** Poitou, J.; Allard, J.P.; Augerat, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1985. 10p. (In French). (CONF-8502101—7; DPh-N-S—2227). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750379.

From 8. biennial session on nuclear physics; Aussois, France (4 Feb 1985).

A 4π light charged particle detector, DIOGENE, is being used at SATURNE to investigate relativistic Heavy Ion collisions. Several α-nucleus and nucleus-nucleus systems have already been measured at different energies. A preliminary data analysis yields informations about the charged pions emitted in those reactions. The differences between π^+ and π^- are qualitatively understood in terms of Coulomb effects and composite particle formation (deuterons) especially at low impact parameter.

12343 **(IFUSP-P—469) Statistical decay of giant monopole resonance in ^{208}Pb.** Dias, H.; Wolynec, E. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700420.

The neutron spectrum from the decay of the monopole giant resonance in ^{208}Pb is calculated using the known energy levels of ^{207}Pb. The particle vibrator model is used to assign spins and parities to the measured ^{207}Pb levels, where these were not avaliable from experiments. The results of the Hauser-Feshbach calculation is in excellent agreement with the experimental spectrum, showing that the observed fast neutrons can be completely explained assuming a statistical decay.

12344 **(TRI-PP—85-1) Inclusive measurement of (p,πsup(-)xn) double charge exchange reactions on bismuth from threshold to 800 MeV.** Dombsky, M.; D'Auria, J.M.; Kelson, I.; Yavin, A.I.; Ward, T.E.; Clark, J.L.; Ruth, T.; Sheffer, G. (TRIUMF, Vancouver, British Columbia (Canada)). Jan 1985. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700452.

The energy dependence of the total angle-integrated cross section for the production of astatine isotopes from (p,πsup(-)xn)

double charge exchange reactions on bismuth (sup(209)Bi) was measured from 120 to 800 MeV using activation and radiochemical techniques. Chemical yields were estimated by direct radioassaying of sup(211)At activity in thin (approximately 1 mg/cmsup(2)), irradiated bismuth targets. Calculations of the contributions of secondary (2-step) reactions to these measured astatine yields were performed, based partially upon the observed sup(211)At activity although even at the highest energies, the contribution to products lighter than sup(207)At was negligible. These data for products with as many as 7 neutrons removed from the doubly coherent product (sup(210)At) display nearby gaussian shapes for the mass distributions of the astatine residues with the maximum occurring for about sup(204)At. The most probable momentum transfer deduced from these distributions for the initial πsup(-) production step was 335 MeV/c. The observed excitation functions display a behaviour similar to that observed for the yield of sup(210)Po from a (p,πsup(O)) reaction on sup(209)Bi, but radically different from that observed for inclusive πsup(-) reactions on a heavy nucleus. These data are discussed in terms of recent theoretical approaches to negative pion production from bismuth. In addition, a simple, schematic model is developed to treat the rapidly decreasing percentage of the total inclusive πsup(-) emission which is observed for this double charge exchange reaction. This model reflects the capacity of a nucleus to a source of internal energetic protons.

12345 **Low-energy optical-model analysis of ^{208}Pb and ^{209}Bi.** Annand, J.R.M.; Finlay, R.W.; Dietrich, F.S. (Ohio Univ., Athens, USA; Lawrence Livermore National Lab., CA, USA). *Nuclear Physics [Section] A;* **443**: No. 2, 249-282(30 Sep 1985).

New measurements of differential elastic and inelastic neutron scattering cross sections for ^{208}Pb and ^{209}Bi at energies 4-7 MeV are presented. Elastic scattering data have sufficient accuracy to reveal clearly differences between cross sections in these neighboring nuclei. Phenomenological and microscopic, spherical, optical-model analyses are performed with compound elastic scattering accounted for using the statistical model. The methods of Moldauer, Tepel et al. and Hofmann et al. for calculating the latter are compared. The improvement to the low-energy phenomenological description resulting from inclusion of a surface-peaked real component to the potential is examined. A possible connection between the observed energy dependence of the real potential and the anomalous behavior of the nucleon reduced mass near the Fermi energy is discussed. Microscopic calculations of the optical potential are made using the methods of Brieva and Rook and Jeukenne et al. Inelastic scattering cross sections for the 7/2 and 13$^+$/2 single-particle states of ^{209}Bi and the first two excited states of ^{208}Pb, the 3 and 5 collective states, are presented. Direct inelastic scattering from these states is calculated using the DWBA or coupled-channel formalism. Compound inelastic scattering is calculated using the statistical model.

12346 **Sequential fission angular distributions from mass-asymmetric heavy-ion reactions.** Morrissey, D.J.; Wozniak, G.J.; Sobotka, L.G.; McDonald, R.J.; Pacheco, A.J.; Moretto, L.G. (Michigan State Univ., East Lansing, USA, National Superconducting Cyclotron Lab.; Lawrence Berkeley Lab., CA, USA. Nuclear Science Div.). *Nuclear Physics [Section] A;* **442**: No. 3, 578-604(9 Sep 1985).

The angular distributions of sequential fission fragments have been measured for the reactions of ^{40}Ar with ^{197}Au and ^{238}U as a function of reaction Q-value and charge transfer. These angular distributions are used to study the angular momentum and alignment of the deep-inelastic products which undergo fission. All of the fission fragment angular distributions are strongly focused into the plane defined by the beam and the projectile-like fragment velocity vectors. The in-plane angular distributions from reactions with uranium are isotropic for small energy losses and become anisotropic as the energy loss increases. For large negative Q-values, the in-plane anisotropy increases as the deep-inelastic products become more symmetric. The variation of the in-plane anisotropy with mass asymmetry for the two systems in this work was compared to a compilation of previous work and a consistent pattern was found. These alignment data are compared to equilibrium statistical calculations.

6520 Nuclear Properties And Reactions, A=220 And Above, Theoretical

REFER ALSO TO CITATION(S) 12352, 12353

12347 **(AECL—8184) Effect of the choice of scattering data, bound or unbound, and the energy group structure on the calculated absorptions in the 1 eV Pu-240 resonance.** Craig, D.S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jan 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700453.

The effect of using free gas or molecular bound scattering data in calculating the absorption of neutrons in 1 eV resonance of Pu-240 was investigated. In the lattice studied, using the data for the bound H and D atoms gave about 12 percent more absorption in the resonance than using the data for the free gas at rest. This is due to differences in the downscattering cross sections. Upscattering is not important. The use of transport corrected in-group scattering cross sections was found to allow for the non-isotropic scattering in calculating the absorption in the resonance as well as the inclusion of P1 Legendre scattering terms. The energy group structure used with the WIMS and RAHAB codes over the 1 eV resonance is adequate. Use of a finer mesh only decreases the calculated absorption by 1 percent.

12348 **(CEA-CONF—7805) Linear momentum transfer in the ^{40}Ar + ^{238}U system for projectile energies from 20 to 44 MeV/u.** Leray, S.; Granier, O.; Ngo, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1985. 9p. (CONF-850173—7; DPh-N-S—2232). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750358.

From 23. international winter meeting on nuclear physics; Bormio, Italy (21 Jan 1985).

Angular correlation measurements between two fission fragments show that about 86% of the initial linear momentum is transferred to the compound system in the ^{40}Ar + ^{238}U reaction at 19.6 MeV/u. At 35 and 44 MeV/u the probability for incomplete fusion, however, is very small. An interpretation, in terms of the highest possible energy content in a nuclear system, is suggested.

12349 **(DOE/ER/10452—14) High resolution studies of photofission of ^{233}Th and ^{238}U.** Zhang, H.X.; Lancman, H. (Brooklyn Coll., NY (USA)). 1984. Contract AC02-79ER10452. 3p. (CONF-840906—22). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004774.

From Capture gamma-ray spectroscopy conference; Knoxville, TN, USA (10 Sep 1984).

Photofission cross sections have been determined in several photon energy intervals with a photon energy resolution ~200 eV. The structure observed at 6.31 MeV in ^{233}Th is interpreted as a reflection of class II compound states in this nucleus. 4 refs., 3 figs., 1 tab.

12350 **(DOE/ER/10452—15) High resolution photofission measurements in ^{238}U and ^{232}Th. Final report.** Lancman, H. (Brooklyn Coll., NY (USA)). Dec 1985. Contract AC02-79ER10452. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004706.

A novel technique for measuring the photofission cross section with very high photon energy resolution has been developed. The photons are obtained from selected resonances in the (p,γ) reaction on various light nuclei. The photon energy resolution approaches 200 eV in favorable cases. The photon energy spread at each (p,γ) resonance is ~20 keV on the average. Measurements of the photo-fission cross sections of ^{233}Th and ^{238}U have been carried out in the energy range from 5.8 to 12 MeV. Intermediate structure has been found in both nuclei at excitation energies around 6 MeV. Various properties of this structure, such as average areas of resonances, their spacing, width, and the underlying bakground, as well as the experimental fission probability averaged over the intermediate structure have been found to agree with theoretical predictions based on a double-humped fission barrier. In the case of ^{232}Th, the feature of this barrier, a rather high first hump and a deep second-

ary well, are quite different from those predicted by current theoretial barrier calculations. 13 refs., 4 figs., 3 tabs.

12351 (DOE/ER/40048—148-N5) Anomalously broad spin distributions in sub-barrier fusion reactions. Vandenbosch, R.; Murakami, T.; Sahm, C.C.; Leach, D.D.; Ray, A.; Murphy, M.J. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). [1985]. Contract AC06-81ER40048. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004305.

The mean-square spin value of the compound nucleus ^{248}Cf has been determined from fission fragment angular distributions for the ^{12}C+^{236}U and ^{16}O+^{232}Th reactions. The anisotropy and hence the mean-square spin values are much larger than expected. Models which reproduce the enhancement observed in the sub-barrier fusion excitation functions fail to account for the spin distribution observations. 12 refs., 3 figs.

12352 (IFUSP-P—497) Non-electric-dipole photofission of ^{235}U. Arruda Neto, J.D.T.; Herdade, S.B.; Carvalheiro, Z.; Simionatto, S.; Berman, B.L. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700454.

The electrofission cross section for ^{235}U has been measured from 5.8 to 22 MeV. From a combined analysis of it and the previously measured photofission cross section, using the virtual-photon formalism, the photofission cross section for excitations other than E1 has been determined.

12353 (IFUSP-P—498) Observation of M1 strength in the photofission of actinide nuclei. Arruda Neto, J.D.T.; Herdade, S.B.; Berman, B.L. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700455.

Electrofission-fragment angular distributions for ^{234}U, ^{236}U, and ^{238}U, in the energy range from 5 to 7 MeV, are analyzed in the framework of virtual-photon formalism, which allows the separation of the multipolar components in the fission channel. Strong evidence for a substantial concentration of M1 strength in the fission decay of these nuclei is found.

12354 (INDC(CCP)—238) Prompt neutron energy spectrum for the spontaneous fission of Cf-252. Blinov, M.V.; Boykov, G.S.; Vitenko, V.A. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jun 1985. 47p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700456.

Translated from Russian.

The prompt neutron spectrum for the spontaneous fission of Cf-252 has been measured in 0.01-10 MeV region by the time-of-flight technique using a fast ionization chamber with U-235 layers as the neutron detector. Numerical data for the spectrum are presented, with an error file.

12355 Neutron-induced fission cross-section measurements of ^{244}Cm, ^{246}Cm, and ^{248}Cm. Maguire, H.T.; Block, R.C.; Dabbs, J.W.T.; Dougan, R.J.; Harris, D.R.; Hoff, R.W.; Lougheed, R.W.; Slovacek, R.E.; Stopa, C.R.S. (Westinghouse Nuclear Technology Division, Westinghouse Nuclear Center-471, Monroeville, Pennsylvania). *Nuclear Science and Engineering:* 89: No. 4, 293-304(Apr 1985).

The fission cross sections of ^{244}Cm, ^{246}Cm, and ^{248}Cm have been measured from 0.1 eV to 80 keV using the Rensselaer Intense Neutron Spectrometer. The cross sections were normalized to the ^{235}U ENDF/B-V broad-bin-averaged fission cross section. Fission areas and widths were determined for the resolved low-energy resonances. In general, the ENDF/B-V fission cross sections for the curium isotopes are in poor agreement with the measured cross sections and a new evaluation of these curium cross sections is recommended. The observation of structure in the measured cross sections in the unresolved region is suggestive of intermediate structure in the even curium isotopes

6530 Nuclear Theory

12356 (ANL-HEP-CP—85-103) Structure functions of nuclei in the pion exchange model. Berger, E.L.; Coester, F. (Argonne National Lab., IL (USA)). Sep 1985. Contract W-31-109-ENG-38. 18p. (CONF-8508127—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE86003061.

From Nuclear chromodynamics conference; Santa Barbara, CA, USA (12 Aug 1985).

A detailed derivation is presented of the fact that the deep inelastic structure function of a nucleus may be expressed directly in terms of the empirical structure functions of the constituent nucleons and mesons and the wave function of the nuclear bound state. The assumptions made are specified. The pion exchange model provides a unified quantitative description for all x of nuclear effects observed in deep inelastic scattering of charged and neutral leptons from nuclei. 9 refs., 1 fig.

12357 (CEA-CONF—7793) Future prospects in photon and electron physics at Saclay. Laget, J.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1984. 19p. (CONF-8410227—7; DPh-N-S—2223). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750375.

From Workshop on electron and photon interactions at medium energies; Bad Honnef, F.R. Germany (29 Oct 1984).

In introduction the two nucleon system is considered. Their interaction is very well described at large distances by the pion exchange potential at intermediate distances by the exchange of two correlated pions. Between the exchange of these two pions, one of the nucleons, or both, can be transformed into a Δ. At small distances the exchange of vector mesons (rho, ω) plays a role, but it is also here that the quark structure of the nucleon is expected to enter the jame. Coincidence experiments performed with the electromagnetic probe are precisely the most strayhtforwad way to answer these questions. This is illustrated by spectra of the electrons inelastically scattered on ^{3}He which are good examples of the interplay between the many body aspects and the internal degrees of freedom of the nucleon. More exclusive experiments must be performed in order to single out each channel and study the various aspects of the nuclear dynamics. An example in each part of these response functions is given. The first one concerns the pion photoproduction at the top of the Δ peak and has to do with the NΔ interaction. The second concerns the creation of virtual pions near the threshold and has to do with the exchange currents. Typical example choosen is the deuteron electrodisintegration near the threshold when the electric is scattered at a given angle. The third one concern the study of the short range correlations by mean of the (e,e'N) and (e,e'NN) reactions.

12358 (CEA-CONF—7822) Subnucleon freedom degrees. Frois, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1985. 50p. (In French). (CONF-8409254—2; DPh-N-S—2237). NTIS (US Sales Only), PC A03/MF A01. File Number DE86750373.

From 3. Joliot-Curie School on nuclear physics: mesons, baryons, quarks; Bombannes, France (16 Sep 1984).

The nucleon is nothing but the fundamental state of a complex object, the Baryon. It has a great number of excited states which are significative of its quark structure. The aim of nuclear physics today is to understand the interaction dynamics in nuclei of particles whose existence is known by high energy physics. This lecture aims at defining the frontier of current comprehension in this field by some examples. First quarks and gluons are presented. Proofs of existence of pinpoint particles inside the nucleus are given. Then a direct proof of the concept validity of the nucleon orbit in the nucleus is given. Mesonic freedom degrees are also studied. Some experience examples in which meson exchange exist clearly are shown. At last, the role of subnucleonic effects in the nuclear reactions is shown.

12359 (DOE/ER/03948—T4) Quasifree production of hyperons from nuclei. Kishimoto, T. (Houston Univ., TX (USA). Dept. of Physics). [1985]. Contract AS05-76ER03948;AC02-76CH00016. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86003459.

The quasifree process (K,π) is considered. The quasifree spectra is calculated by specifying the final state of the residual nucleons. The wavefunction which duplicates experimental momentum distributions for the (e,e'p) reaction is chosen in terms of the form factors at the two vertices of the reaction. 9 refs., 3 figs. (WRF)

12360 (DOE/ER/40048—03-N6) Stellar weak interaction rates: the issue of quenching. Fuller, G.M. (Washington Univ., Seattle (USA). Inst. for Nuclear Theory). Sep 1985. Contract AC06-81ER40048. 4p. (CONF-8509148—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004304.

From TRIUMF accelerated radioactive beams workshop; Parksville, BC, Canada (4 Sep 1985).

Electron capture and emission, positron capture and emission, and neutrino capture and emission are important nuclear processes in stellar structure and evolution calculations. There are detailed calculations of the rates of these processes for a large number of nuclear species under a wide range of stellar conditions. The nuclear data which serves as input for these calculations is adequate save for the magnitude of quenching in the T < → T >, or (n,p) electron capture channel. 11 refs.

12361 (DOE/ER/40048—25-N5) Dynamics of six-quark systems in the soliton bag model. Schuh, A.; Pirner, H.J.; Wilets, L. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Theoretische Physik; European Organization for Nuclear Research, Geneva (Switzerland); Washington Univ., Seattle (USA). Inst. for Nuclear Theory). 1985. Contract AC06-81ER40048. 11p. (CONF-850141—6; CERN-TH—4218/85). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004298.

From 13. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (14 Jan 1985).

The soliton bag model introduced by Friedberg and Lee is applied to S-wave nucleon-nucleon scattering. The dynamics of six quarks and their confining soliton field is treated in the generator co-ordinate method. We find an attraction of 120 MeV at a NN separation of 2.5 fm, but no attraction in the vicinity of the spherically symmetric shape of the system. This is in contradiction to approaches using naive adiabtic potentials. 17 refs., 2 figs.

12362 (DOE/ER/40048—30-N5) Quarks and nuclear properties. Miller, G.A. (Washington Univ., Seattle (USA)). 1985. Contract AC06-81ER40048. 11p. (CONF-8508127—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004297.

From Nuclear chromodynamics conference; Santa Barbara, CA, USA (12 Aug 1985).

The nucleus is treated as a collection of nucleons, mesons and 6-quark bags. This allows one to include quark effects in the computations of nuclear properties. Examples are calculations of the ^{3}He, ^{3}H magnetic moments and binding energy difference. New results for the process π^-(pp) → np are presented. A mechanism in which a pion is absorbed by a quark in a six-quark bag is used, and good agreement with experiment is obtained. 23 refs., 4 figs.

12363 (IFUSP-P—457) Theory of the heavy ion fusion cross section. Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Mar 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700415.

A general reaction theory of the heavy-ion fusion cross section that exhibits clearly the possible effects of directly coupled channels is developed. The expression obtained for the fusion cross section show how the presence of coupled channels enhances its value in general. The result may be used to standardize the discussion of, e.g., sub-barrier heavy-ion fusion in general.

12364 (IFUSP-P—458) Polarization potentials in heavy ion scattering. Hussein, M.S.; Baltz, A.J.; Carlson, B.V. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 123p. NTIS (US Sales Only), PC A06/MF A01. File Number DE86700416.

A polarization potential is defined in terms of the Feshbach projection operator formalism to represent the effect upon the elastic channel of the coupling to non-elastic channels in heavy ion scattering. The polarization potential represents coupling to specific surface degrees of freedom of the particular reaction considered and it is contrasted to the complementary global approaches for the volume potential such as the folding model and the proximity potential. The coupled channels method is used both as a source of exact model solutions for comparison with the various approximate potential forms and also as a numerical means of constructing trivially equivalent local potentials. The imaginary Coulomb polarization potential is due in lowest order to quadrupole coupling to the lowest collective 2^+ state of a nucleus. It is considered in detail since it provides the insight of closed analytical forms in various approximations. Multistep coupling to higher states, energy loss and off-energy shell effects are also considered analytically. The real Coulomb polarization potential due to the virtual excitation of multipole giant resonances, and the polarization potential arising from relativistic connections, are investigated in detail. Polarization potential components due to nuclear coupling are investigated numerically for inelastic scattering and particle transfer. Approximate analytical expressions for the nuclear polarization potential are surveyed and tested numerically. Analytical cross section approaches are contrasted with the polarization potential approach and with coupled channels.

12365 (IFUSP-P—462) Photonuclear physics at intermediate energies. Arruda Neto, J.D.T. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 37p. (In Portuguese). (CONF-8405363—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE86700417.

From 5. national meeting on intermediate energy physics; Gramado, Brazil (7 May 1984).

A review on photonuclear reactions at intermediate energies is made. It covers from quasi-deuteron to meson photoproduction region. Several data for this subject are presented.

12366 (IFUSP-P—477) Role of peripheral partial waves in the anomalous large angle scattering of n-α nuclei. Aleixo, A.N.F.; Canto, L.F.; Carrilho, P.; Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 36p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700423.

Properties of the elastic excitation function at 180° produced by deviations from the usual strong absorption S-matrix are studied. Deviations S approx. with the shape of windows in l-space, centered around a value l approx. corresponding to a peripheral collision are considered and the analysis is concentrated in the interference of the partial waves neighbouring l approx. The conditions for constructive and destructive interference and the effect of odd-even staggering factors are investigated, in the presence and in the absence of Coulomb and nuclear refraction. The consequences of such interference on the anomalous behaviour of the 180° excitation function for the elastic scattering of some n-α nuclei are discussed, in connection with results of other works.

12367 (IFUSP-P—500) Deformation effects in the heavy ion quarter-point angle. Almeida, F.I.A. de; Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700425.

The effects of static and dynamic deformation on the heavy-ion elastic scattering quarter-point angle are discussed and analyzed in the sudden approximation. Simple expressions are derived within the Fresnel model and applications to several heavy-ion systems are presented.

12368 (ISN—84-37) Semiclassical description of currents in normal and superfluid rotating nuclei. Durand, M.; Schuck, P.; Kunz, J. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Aug 1984. 47p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86750353.

First the technique of partial M-resummation is used to obtain semiclassical current distributions of slowly rotating normal fluid nuclei. We find that the average intrinsic current flows mainly in the nuclear surface. The analogy with the Bohr-van Leeuven theorem of diamagnetism is pointed out. Strutinsky- and temperature-averaged calculations are in good agreement with the semiclassical results. Secondly we study rotating superfluid nuclei and find in semicalssical aopproximation analytic closed expressions for the currents using a deformed harmonic oscillator potential. The currents pass with increasing gap continuously from rigid rotation flow to irrotational flow patterns. Analogous results hold true for the moment of inertia. For a fixed value of the gap our formulas for the moment of inertia interpolate smoothly between irrotational flow and rigid body values as a function of deformation.

12369 **(JINR—E-1-84-417) Emission of light fragments ^{3}H, ^{3}He and ^{4}He in ^{4}He-nucleus collisions at 3.33 GeV/N kinetic energy.** Abashidze, L.I.; Beznogikh, G.G.; Budilov, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700431.

Submitted to the journal Nucl. Phys., A.

Inclusive cross sections for emission of ^{3}H, ^{3}He, and ^{4}He at laboratory angles of 45 deg, 90 deg and 135 deg in collisions of ^{4}He with targets ^{9}Be, ^{12}C, ^{27}Al, ^{64}Cu, ^{108}Ag, and ^{197}Au at a beam kinetic energy of 3.33 GeV/nucleon are presented. Assuming the existence of a moving object emitting fragments, its velocity and temperature for different fragment energies are found. It is shown that the velocity and temperature continuously increase with the fragment energy under consideration. The evaporation mechanism is discussed, and it is argued that the evaporation significantly contributes to the yield of fragments with energy less than 50 MeV. The considered ^{3}H to ^{3}He ratio is found to be larger than the neutron to proton ratio in the emitting system. Comparing ^{3}H and ^{3}He spectra, an important role of the Coulomb barrier is shown. The A dependence of the yield of the fragments is studied. The experimental spectra are compared with thermodynamic firestreak model predictions. The model is successful in describing the emission of fragments with energy greater than 50 MeV.

12370 **(JINR—E-2-84-124) Multiquark states in nuclei and the deep inelastic scattering.** Efremov, A.V.; Bondarchenko, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700428.

Submitted to the journal Sov. J. Nucl. Phys. .

Based on a hypothesis of multiquark states in nuclei, the nucleus structure functions are considered and the results are compared with experiment. It is shown that the multiquark state contributions are sufficiently high (up to 20% in deuterium and 40% in iron) and must possess a greater, than in a nucleon, sea of quark-antiquark pairs. Also the comparison with the cumulative particle production cross sections is performed. The predictions are given for a further experimental test of that hypothesis.

12371 **(KIYI—84-3) Unification of the Krylov-Fock theorem and solution of Davydov paradox of the decaying systems.** Ol'khovskij, V.S. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1984. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700430.

The Krylov-Fock theorem about the law of metastable state decay is generalized and the bounds are examined for its application to the decay of compound nuclei formed in nuclear reactions. The Davydov paradox of the decaying systems is discussed and its resolution is proposed. Two theorems about connection between the decay law and the distribution of the lifetimes of decaying systems are proved.

12372 **(LA-UR—85-3733) Few-body strange systems.** Gibson, B.F. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 15p. (CONF-8509142—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE86002445.

From Geothermal program review; Washington, DC, USA (11 Sep 1985).

Three fascinating aspects of few-body Λ-hypernuclei are discussed: 3-body forces, charge symmetry breaking, and ΛN-ΣN coupling. The need for improved data on hyperon-nucleon scattering is emphasized. 29 refs., 3 tabs.

12373 **(ORNL/TM—9727) High Energy Transport Code HETC.** Gabriel, T.A. (Oak Ridge National Lab., TN (USA)). Sep 1985. Contract AC05-84OR21400. 24p. (CONF-850140—2-Rev.). NTIS, PC A02/MF A01; GPO Dep. File Number DE86001366.

From LEP experimenters' workshop on shower simulation; Geneva, Switzerland (29 Jan 1985).

The physics contained in the High Energy Transport Code (HETC), in particular the collision models, are discussed. An application using HETC as part of the CALOR code system is also given. 19 refs., 5 figs., 3 tabs.

12374 **(TRI-PP—85-64) Nuclear liquid-gas phase transition.** Boal, D.H. (Simon Fraser Univ., Burnaby, British Columbia (Canada). Dept. of Physics). Aug 1985. 5p. (CONF-850672—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900368.

From 2. international conference on nucleus-nucleus collisions; Visby, Sweden (10 Jun 1985).

The temperature and density regions where the nuclear liquid-gas phase transition is expected to occur are reviewed. By means of numerical simulations of the reaction trajectories of both proton and heavy ion induced reactions, it is shown that the mechanical instability region should be easily accessible. The change in entropy expected in crossing the isentropic spinodal at low initial entropy per nucleon is estimated and shown to be in agreement with that observed experimentally. 25 refs., 6 figs.

12375 **Subthreshold kaon production as a probe of the nuclear equation of state.** Aichelin, J.; Ko, C.M. (Joint Institute for Heavy Ion Research, Holifield Heavy Ion Research Facility, Oak Ridge, Tennessee 37831). *Physical Review Letters;* **55**: No. 24, 2661-2663(9 Dec 1985). Contract AS05-76ER04936.

The production of kaons at subthreshold energies from heavy-ion collisions is sensitive to the nuclear equation of state. In the Boltzmann-Uehling-Uhlenbeck model, the number of produced kaons from central collisions between heavy nuclei at incident energies around 700 MeV/nucleon can vary by a factor of ~ 3, depending on the equation of state.

12376 **Analysis of angular-momentum-projected Hartree-Fock-Bogoliubov wave functions in terms of interacting bosons.** Pannert, W.; Ring, P.; Gambhir, Y.K. (Technische Univ. Muenchen, Garching, Germany, F.R., Fakultaet fuer Physik; Lawrence Berkeley Lab., CA, USA. Nuclear Science Div.; Indian Inst. of Tech., Bombay. Dept. of Physics). *Nuclear Physics* [*Section*] *A;* **443**: No. 2, 189-209(30 Sep 1985).

Angular-momentum- and number-projected Hartree-Fock-Bogoliubov (HFB) wave functions of translational and deformed rare earth nuclei are analyzed in terms of fermion pairs coupled to angular momenta L = 0(S), 2(D), 4(G). The fermion space is truncated to contain only S-D or S-D-G pairs. The variation is carried out before and after angular momentum projection and also with different truncations. The influence of the truncation on physical quantities such as moments of inertia, quadrupole moments or pair transfer matrix elements is discussed.

12377 **Optical potential ambiguities and fusion cross sections for heavy ions.** Shalaby, M.M.; Satchler, G.R. (Oak Ridge National Lab., TN, USA. Physics Div.). *Nuclear Physics* [*Section*] *A;* **442**: No. 3, 469-477(9 Sep 1985).

We explore some of the effects of optical-potential ambiguities on the fusion cross sections for heavy-ion collisions, especially at energies below the top of the Coulomb barrier when the barrier-penetration model is used. Ambiguities of the Igo type in the real potential are found to have little effect except when the potential is very shallow. The cross sections are seen to be very sensitive to the imaginary potential adopted if this allows for some absorption within the barrier; both the magnitude and shape of the excitation function may be changed.

12378 **Statistics at work in heavy-ion reactions.** Moretto, L.G. (Lawrence Berkeley Lab., CA, USA. Nuclear Science Div.). pp 312-388 of Nuclear structure and heavy-ion dynamics. Proceedings. Moretto, L.; Ricci, R.A. Amsterdam, Netherlands; North-Holland (1984). (CONF-820746—).

From Enrico Fermi International School of Physics on nuclear structure and heavy ion dynamics; Varenna, Italy (27 Jul 1982).

The topics that I have chosen are the following: in the first one I discuss certain new aspects of the compound-nucleus decay brought into the limelight by the very special conditions prevailing in heavy-ion reactions. In particular, we discuss the statistical emission of particles of intermediate mass and we investigate experimentally the existence of such a process. Furthermore, we reconsider the standard Bohr-Wheeler approximation in the calculation of the fission decay width and we shall present a more general approach to the problem. In the second part we consider the problem of angular-momentum transfer and alignment in a variety of heavy-ion reactions. Experimentally, we use sequential alpha, gamma and fission decay as different probes of the angular momentum in deep inelastic fragments.

12379 **Nuclear matter theory: a status report.** Jackson, A.D. (Dept. of Physics, State Univ. of New York, Stony Brook, NY). *Annual Review of Nuclear and Particle Sciences;* **33**: 105-141(1983).

Recent years have brought considerable improvement in the quality of both diagrammatic and variational many-body techniques. There appears to be general agreement that realistic NN potentials give a reasonable binding energy but an equilibrium density that is some 75% larger than the empirical value. Both conventional and chiral models of genuine manybody forces offer mechanisms for removing this discrepancy with each providing a simple picture for the required additional attraction for /rho/ < /rho/$_0$. Neither approach is presently able to make a priori estimates of the magnitude of this effect with the delicacy required by the nuclear matter problem. Nor is it clear how to merge these pictures. We should not anticipate quick answers to these questions. One suitable interim strategy is to assume that many-body forces of the form suggested by either conventional or chiral pictures are responsible for the remaining discrepancy and to adjust parameters in such model many-body forces to restore agreement between theory and experiment. This might seem to be a summary dismissal of the standard nuclear matter problem. It should rather be regarded as revealing the next and richer layer of the nuclear matter problem.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 12118, 12273, 12280, 12389

12380 **(AAEC-LIB/Trans—790) Determination of gamma-ray peak efficiency, including correction for self-absorption, in cubic samples.** Sato, K.; Takano, N.; Imazawa, Y.; Higuchi, H.; Noguchi, M. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Sep 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700409.

Translated from Radioisotopes (Jan 1983) v. 32(1) p. 1-6.

By developing on the existing method, which expreases the calculated efficiency of bulk samples as the product of a term which depends only on energy and a term which depends only on the thickness of the sample, we arrived at a method of calculating efficiency, which includes self-absorption, by using approximation by (a set of) parallel lines to the latter. This method involves finding the two parameters experimentally by using one set of single energy, base bulk source of gamma radiation with different heights (for example, ^{137}Cs solution), and then combining them with a relative efficiency curve obtained from a multi-nuclide point source of radiation. This method has the advantage that it is easy to use. As a result of measuring various types of mock samples which have densities and gamma-ray energy which cover a wide range of actual environmental samples using a Ge semiconductor spectrometer, we have shown that errors resulting from self-absorption can be adequately corrected and can be of practical use.

12381 **(CEA-CONF—7559) X-neutron comparative study of direct ionic micelles.** Zemb, T. Charpin, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1984. 27p. (CONF-8407121—4). NTIS (US Sales Only), PC A03/MF A01. File Number DE86750363.

From 5. international symposium on surfactants in solution; Bordeaux, France (9 Jul 1984).

We present the first application to X-ray scattering of the method of Hayter and Penfold for separating inter- from intramicellar scattering. Two typical ionic micellar systems are studied. A particular feature of SDS is that the interference peak is cancelled by a dip of the form factor for X-rays. This is not the case for other systems. Compared to neutron scattering, the X-ray scattering is subject to more uncertaineties since the strongest contrast for X-rays are the counter-ions rather than the hydrophonic core. No quantitative study can be made on concentrated ionic micelles without separation of interference term.

12382 **(CEA-CONF—7902) Vectorization and multitasking with a Monte-Carlo code for neutron transport problems.** Chauvet, Y. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Apr 1985. 12p. (CONF-8504110—20). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750106.

From Joint Los Alamos/CEA meeting on Monte Carlo methods; Cadarache, France (22 Apr 1985).

This paper summarizes two improvements of a Monte Carlo code by resorting to vectorization and multitasking techniques. After a short presentation of the physical problem to solve and a description of the main difficulties to produce an efficient coding, this paper introduces the vectorization principles employed and briefly describes how the vectorized algorithm works. Next, measured performances on CRAY 1S, CYBER 205 and CRAY X-MP are compared. The second part of this paper is devoted to multitasking technique. Starting from the standard multitasking tools available with FORTRAN on CRAY X-MP/4, a multitasked algorithm and its measured speed-ups are presented. In conclusion we prove that vector and parallel computers are a great opportunity for such Monte Carlo algorithms.

12383 **(JINR—E-1-84-855) Stopping and energy deposition of hadrons in target nuclei.** Strugalski, Z.; Pluta, J.; Pawlak, T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700444.

Collision events in which an incident hadron is stopped and deposits its energy inside a massive target nucleus were studied at 2-9 GeV/c momentum. The number of observed "stopped" events decreases rapidly with incident hadron energy increase. Hadrons loss their kinetic energies in passing through nuclear matter proportional to their path length in it.

12384 **(LA-UR—85-4335) Comparison of models for the free-free Gaunt factor at low temperatures and frequencies.** Collins, L.A.; Merts, A.L. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 21p. (CONF-8510172—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004742.

From 3. international conference and workshop on radiative properties of hot dense matter; Williamsburg, VA, USA (14 Oct 1985).

We perform calculations for the free-free Gaunt factor at electron and photon energies below 1 Ry in the dipole approximation to the radiation field for a variety of representations of the scattering potential. We consider the static-exchange, static-exchange + model polarization, model exchange, and static models. Within each model, the resulting Schroedinger equation is solved exactly using a linear algebraic prescription. We investigate the rare gas and alkali systems. We find great sensitivity to the models for energies below four electron volts (4 eV). Above this energy, the Gaunt factors for the various models come into better agreement. 31 refs., 3 figs., 1 tab.

12385 **(LBL-PUB—490) X-Ray Data Booklet. Center for X-Ray Optics.** Vaughan, D. (ed.). (Lawrence Berkeley Lab., CA (USA)). Oct 1985. Contract AC03-76SF00098. 155p. NTIS, PC A08/MF A01; GPO Dep. File Number DE86005122.

12386 **(ORNL/TM—9767) Integrated Tiger Series of electron/photon Monte Carlo transport codes: a user's guide for use on IBM mainframes.** Kirk, B.L. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005114.

The ITS (Integrated Tiger Series) Monte Carlo code package developed at Sandia National Laboratories and distributed as CCC-467/ITS by the Radiation Shielding Information Center (RSIC) at Oak Ridge National Laboratory (ORNL) consists of eight codes - the standard codes, TIGER, CYLTRAN, ACCEPT; the P-codes, TIGERP, CYLTRANP, ACCEPTP; and the M-codes ACCEPTM, CYLTRANM. The codes have been adapted to run on the IBM 3081, VAX 11/780, CDC-7600, and Cray 1 with the use of the update emulator UPEML. This manual should serve as a guide to a user running the codes on IBM computers having 370 architecture. The cases listed were tested on the IBM 3033, under the MVS operating system using the VS Fortran Level 1.3.1 compiler.

12387 **FASTBUS data acquisition system for neutron time-of-flight measurements.** Nelson, R.O.; Barrus, D.M.; Cort, G.; Goldstone, J.A.; Machen, D.R.; McMillian, D.E.; Poore, R.V. (Los Almos National Lab., Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 1, 248-250(Feb 1985). (CONF-841007—).

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

The design of a new data acquisition system for the Weapons Neutron Research Facility is based on the FASTBUS system hosted by DEC computers. System and FASTBUS configurations are discussed. Modules unique to pulsed time-of-flight measurements are presented.

6550 Medical Physics

REFER ALSO TO CITATION(S) 11998, 12003, 12003

12388 **(ARL/TR—068) OECD/NEA Radon Intercalibration and Intercomparison Programme Pacific Region Intercomparison Programme.** Solomon, S.B.; Gan, W.; Peggie, J.R. (Australian Radiation Lab., Melbourne). Apr 1985. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700457.

An intercomparison of radon-in-air measurements between twelve laboratories in Australia and Japan has been carried out as part of the OECD/NEA and CEC International Radon Intercomparison and Intercalibration Programme. The methodology for this phase of the programme is described and the results of the intercomparison of radon measurements and of passive radon monitors are reported.

12389 **(CONF-851113—2) Physical and chemical events that follow the passage of a charged particle in liquid water.** Wright, H.A.; Hamm, R.N.; Turner, J.E.; Magee, J.L.; Chatterjee, A. (Oak Ridge National Lab., TN (USA); Lawrence Berkeley Lab., CA (USA)). 1985. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004761.

From Radiopharmaceutical dosimetry symposium; Oak Ridge, TN, USA (5 Nov 1985).

Biological effects of radiation are the result of a complicated sequence of events that begins with initial physical interactions that are complete by $\sim 10^{-15}$ s, followed by chemical interactions that begin at $\sim 10^{-11}$ s and are complete by $\sim 10^{-6}$ s, and followed by later biochemical and biological events, some of which may not occur for years. A central problem in radiation physics and radiation chemistry is to understand the details of the physical and chemical events that occur during that first microsecond following the passage of a charged particle. Significant progress has been made recently at linking early physical events with later chemical events. We have developed a Monte Carlo computer code to calculate the position and identity of each physical event that a charged particle (electron, proton, alpha) and all of its secondaries undergoes in traversing liquid water. The code then calculates the position and identity of each reactive chemical species (ion or radical) that is produced from these physical events and is present at 10^{-11} s, and then follows each reactant through the diffusion and chemical reaction stage of track development. This work will be discussed and examples of "pictures" of charged-particle tracks at various times will be shown. 11 refs., 9 figs.

12390 **(INIS-mf—9626-Vol.1, pp 37-41) Microdosimetry of gamma and neutron radiation. State-of-the-art and recent experimental data.** Srdoc, D. (Columbia Univ., New York (USA). Coll. of Physicians and Surgeons). 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE85781216. (CONF-830995—Vol.1).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

A wide range of neutrons and photon energies has been used to obtain energy deposition spectra in small tissue volumes ranging from 100 nm to 8 μ m in diameter. The experimental data were obtained by means of a Rossi-type wall-less proportional counter filled with tissue-equivalent gas. The counter was irradiated with monoenergetic neutrons from the Tandem Van de Graaf accelerator at the Radiobiological Radiation Facility of the Brookhaven National Laboratory. Neutron beams varying in energy from 0.22 to 14 MeV in discrete steps and two gamma emitters (^{137}Cs and ^{60}Co) represented a wide range of radiation sources used to produce basic data in form of d(y) vs y spectra for subsequent use in microdosimetry, radiobiology and radiation protection. A selection of microdosimetric spectra of low, medium and high energy neutrons is presented and discussed, as well as gamma ray spectra at very small site sizes. The mean values antiysub(D) and antiysub(F) for all measured spectra are given in keV/μm. The present state-of-the-art in experimental technique and some basic limitations of the experimental method are presented. The implications of microdosimetry data on radiation protection standards is briefly discussed.

12391 (INIS-mf—9626-Vol.2, pp 18-24) **Neutron dose distribution in a water phantom irradiated with 14 MeV neutrons.** Miric, I.; Ilic, R.; Vukcevic, M.; Kaljevic, J. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). 1984. NTIS (US Sales Only), PC A13/MF A01. File Number DE85781217. (CONF-830995—Vol.2).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

Neutron spectra at various depths in a water phantom irradiated by a collimated beam of 14 MeV neutrons were calculated using the Monte Carlo technique. These spectra were used to calculate neutron dose distribution at different depths of the phantom, as well as to predict sulphur and Mg activation at the investigated positions of the phantom. The calculated values were verified experimentally by measuring activation of S-and Mg-pellets in different depths of a corresponding bottle phantom irradiated homogeneously by 14 MeV neutrons.

12392 **(SSI—85-08) Radioactive substances in building materials. A compilation of results from samples examined at SSI.** Moere, H. (National Inst. of Radiation Protection, Stockholm (Sweden)). Feb 1985. 56p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86700486.

The report reviews all activity measurements performed on building materials at SSI during 1962 and 1972-1984. The content of 232-Th, 226-Ra and 40-K was determined. The measuring method and the accuracy is discussed. Comparisons are made to measurements from the 1950's.

12303 **Department of Energy briefing session statement.** Davies, R.W. (Dept. of Energy, Washington, DC). pp 291-295 of Some issues important in developing basic radiation protection recommendations. Bethesda, MD; National Council on Radiation Protection and Measurements (1985). (CONF-840461—).

From 20. annual meeting of the National Council on Radiation Protection and Measurements; Washington, DC, USA (4 Apr 1984).

The roles of NCRP in assisting government agencies in several current issues of radiation protection is discussed. These issues include: standards uniformity, the application of risk, levels below concern, application research and the development process of basic radiation protection standards. The Department of Energy calls on NCRP to establish a closer interface with the ICRP to assure uniformity and consistency between ICRP and NCRP recommendations; that new NCRP recommendations should be supported by documentation that clearly demonstrates improvement in radiation protection programs or, alternatively, is justified on the basis of better scientific knowledge, or both.

12304 **(ORNL-tr—5244) Preliminary radiation protection tests for the body height and body weight of the Chinese reference man.** Shan, Z.Y.; Chang, Z.Y.; Lan, W.Z.; Yin, G.A.; Li, G.F. (Oak Ridge National Lab., TN (USA)). [1985]. Contract AC05-84OR21400. Translation source information not available . 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004569.

The radiation protection standard recommended by ICRP was evaluated in terms of its suitability for Chinese people. The body height and weight of 100,325 healthy Chinese were measured and anatomical data collected from usable corpses of persons who died by accident or sudden death. The data included the size and weight of certain organs. 18 refs. (ACR)

6560 Solid-state Physics

REFER ALSO TO CITATION(S) 11543, 11577, 11595, 12273

12305 **(CBPF-NF—029/84) Potts ferromagnet correlation length in hypercubic lattices: Renormalization - group approach.** Curado, E.M.F.; Hauser, P.R. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700351.

Through a real space renormalization group approach, the q-state Potts ferromagnet correlation length on hierarchical lattices is calculated. These hierarchical lattices are built in order to simulate hypercubic lattices. The high-and-low temperature correlation length asymptotic behaviours tend (in the Ising case) to the Bravais lattice correlation length ones when the size of the hierarchical lattice cells tends to infinity. It is conjectured that the asymptotic behaviours of several values of q and d (dimensionality) so obtained are correct. Numerical results are obtained for the full temperature range of the correlation length.

12306 **(DOE/ER/45072—18) Spectroscopy of surface adsorbed molecules (scanning tunneling microscopy). Progress report, May 1, 1985-April 30, 1986.** Coleman, R.V. (Virginia Univ., Charlottesville (USA). Dept. of Physics). 1986. Contract FG05-84ER45072. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004508.

A review of the scanning tunneling microscopy program is given. This article contains a description of the design and fabrication of the microscope in addition to description of studies which use the microscope: studies of charge-density waves and studies of tunnel junctions doped with metals and semiconductors. 48 refs., 26 figs. (WRF)

12307 **(IFUSP-P—452) Phenomenological renormalization group calculations for 12- and 16- vertex models on a square lattice.** Stilck, J.F.; Oliveira, M.J. de; Salinas, S.R.A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Feb 1984. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700353.

Phenomenological renormalization group calculations for ferroelectric 12- and 16- vertex models on a square lattice with periodic and helical boundary conditions are performed. Strips of infinite length and finite widths (n=1 to 7, 8 or 9) are considered. The extrapolated values for the transition temperature of the 12-vertex model, which has been used for assessing the transition in squaric acid, are lower than the predictions of the Bethe approximation. The estimates for the critical exponent ν do not allow a definite conclusion about its asymptotic behaviour, although the Ising value $\nu=1$ seems more plausible. The estimates for the 16-vertex model considered here, which is equivalent to an anisotropic nearest-neighbor Ising model, show an excellent convergence to the exact values. Also, the finite size scaling behaviour of the critical free energy of both models is analyzed.

12308 **Free energy difference calculations comparing fcc and hcp structures using molecular dynamics computer simulations.** Moody, M.C.; Ray, J.R.; Rahman, A. (Kinard Laboratory of Physics, Clemson University, Clemson, South Carolina 29631). *Journal of Chemical Physics;* **84**: No. 3, 1795-1802(1 Feb 1986).

Molecular dynamic computer simulation methods have been employed to calculate the free energy difference between the fcc and hcp structures using a Morse potential parametrized to model Ni. The calculation is carried out for a temperature (~1000 K) where anharmonic effects are important and also for a range of interactions about each particle. In addition, at the same temperature, another calculation using only nearest neighbor interactions was performed. Using lattice sums the potential energy for the two static lattices was calculated. For the Morse potential used, static lattice sums give a lower potential for the hcp structure. With only nearest neighbor interactions, the fcc—hcp free energy difference is determined only by the entropy difference. In this case the fcc structure has the lower free energy. When both anharmonic effects and longer range interactions are considered we find, at the temperature and density investigated, that the hcp structure is more stable.

6561 Superconductivity

REFER ALSO TO CITATION(S) 11531

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 12231, 12434, 12487

12309 **(CNRS-CPT—84-P-1699) Stability and instability in quantum mechanics.** Bellissard, J. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). 1984. 108p. NTIS (US Sales Only), PC A06/MF A01. File Number DE86750313.

This work is an attempt to describe the problem of stability and instabilities of quantum systems and involving very delicate experiments in molecular physics and solid state physics. A kind of transition to chaos occurs and few theoretical models have been proposed to investigate such a transition but it is better to use the term instabilities waiting for calling such an effect quantum chaos.

12400 **(CNRS-CPT—84-P-1709) Estimates of quantum deviations from classical mechanics using large deviation results.** Blanchard, P.; Combe, P.; Sirugue, M.; Sirugue-Collin, M. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). Nov 1984. 5p. (CONF-8410348—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750335.

From 2. workshop on quantum probability applications; Heidelberg, F.R. Germany (1 Oct 1984).

Classical and quantum motions of particles are very different. Indeed one cannot assign a trajectory to a quantum particle. However one has the physical intuition that quantum particles wander around the corresponding classical path in phase space by an amount of h. Deviations come from the uncertainty principle. Underlying this picture, there are two ideas: i) there is some kind of probability associated with possible paths; ii) this probability concentrates around the classical path in a region whose magnitude is related to h. We want to show that there exists in phase space a probabilistic schema which accounts in a much more transparent

way for the intuitive ideas alluded above. It is convenient to deal with the description of quantum states not in term of wave function but in term of Wigner functions. It allows a more symmetrical treatment of phase-space variables. Also it is expected to be a less singular object than the wave function in the classical limit. Second section is devoted to describe the elementary results concerning Wigner function. It also describes the time development equation of these functions. In the third section we describe the quantum flow which represents the quantum dynamics in phase space. In the last section, we study the asymptotics of this flow showing that it tends in a suitable sense to the classical flow. The most useful tool for this study is the Ventsel's theory of large deviations. This theory already proved to be very efficient in the study of classical limit. However it has not been used for jump processes up to now.

12401 **(CNRS-CPT—84-PE-1712) Deficiency indices and singular boundary conditions in quantum mechanics.** Bulla, W. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86750311.

We consider Schroedinger operators H in L^2 (Rsup(n)), n from IN, with countably infinitely many local singularities of the potential which are separated from each other by a positive distance. It is proved that due to locality each singularity yields a separate contribution to the deficiency index of H. In the special case where the singularities are pointlike and the potential exhibits certain symmetries near these points we give an explicit construction of self-adjoint boundary conditions.

12402 **(IC—85/25) Squeezing and antibunching in a one electron FEL model.** Orszag, M.; Ramirez, R. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1985. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700303.

A full non-linear analysis shows a small amount of squeezing on the combined electron photon state as well as antibunching in a limited range of the wiggler parameter, in a quantum one-electron free electron laser model. We also find a large increase in the average photon number reaching a saturation, as one increases the wiggler parameter.

12403 **(IFT-P—18/84) From GCM energy kernels to Weyl-Wigner Hamiltonians: a particular mapping.** Galetti, D. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1984. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700304.

A particular mapping is established which directly connects GCM energy kernels to Weyl-Wigner Hamiltonians, under the assumption of Gaussian overlap kernel. As an application of this mapping scheme the collective Hamiltonians for some giant resonances are derived.

12404 **(IFUSP-P—454) Homotopy and statistics in quantum theory.** Fernandes, N.C.; Cattani, M.S.D. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Feb 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700305.

The description of a system of N particles is given in terms of the space of motions U introduced by Souriau. The corresponding quantizable manifold U' is introduced and its homotopy group π_1 (U') is exhibited. Some general ideas on the geometrical quantization of U' are presented and the relations of this quantization procedure with the characters of π_1 (U') are discussed.

12405 **(IFUSP-P—468) Forced harmonic oscillator with damping and thermal effects.** Menezes Franca, H. de; Thomaz, M.T. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700306.

Nonperturbative quantum mechanical solutions of the forced harmonic oscillator with radiation reaction damping are obtained from previous analysis based on Stochastic Electrodynamics. The transition to excited states is shown to be to coherent states which follow the classical trajectory. The quantum Wigner distribution in phase space is constructed. All the results are extended to finite temperatures.

12406 **(IFUSP-P—470) Dynamics of the nuclear one-body density: small amplitude regime.** Nemes, M.C.; Toledo Piza, A.F.R. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700307.

A microscopic treatment for the small amplitude limit of the equations of motion for the nuclear one-body density is presented. These were derived previously by means of projection techniques, and allow for the explicit separation of mean-field and collision effects which result from the dynamics of many-body correlations. The form of the nuclear response in the presence of collision effects is derived. An illustrative application to a soluble model is discussed.

12407 **(IFUSP-P—491) Bound-states of N particles: a variational approach.** Perez, J.F.; Malta, C.P.; Coutinho, F.A.B. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700308.

Using a variational technique sufficient conditions for the existence of a bound-state in a system of N particles in one-, two- and three-dimensions are provided.

12408 **(ITEP—189(1984)) Quantum decay rate of metastable phase in (1 + 1) dimensions.** Voloshin, M.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700309.

By means of the effective action method the rate of quantum decay of false vacuum in (1 + 1) dimensions is expressed in the form of a universal closed formula whose validity does not rely on semiclassical expansion.

12409 **(TRI-PP—83-95) FORTRAN program (RELAX3D) to solve the 3 dimensional Poisson (Laplace) equation.** Houtman, H.; Kost, C.J. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1983. 6p. (CONF-8309144—11). NTIS (US Sales Only), PC A02/MF A01. File Number DE86700311.

From EPS conference on computing in accelerator design and operation; Berlin, F.R. Germany (20 Sep 1983).

RELAX3D is an efficient, user friendly, interactive FORTRAN program which solves the Poisson (Laplace) equation $\Delta^2=p$ for a general 3 dimensional geometry consisting of Dirichlet and Neumann boundaries approximated to lie on a regular 3 dimensional mesh. The finite difference equations at these nodes are solved using a successive point-iterative over-relaxation method. A menu of commands, supplemented by HELP facility, controls the dynamic loading of the subroutine describing the problem case, the iterations to converge to a solution, and the contour plotting of any desired slices, etc.

12410 **(UFPB-DF—10/84) Quantum theory of a one-dimensional laser with output coupling. 2. Nonlinear theory.** Penaforte, J.C.; Baseia, B. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica). 1984. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86700312.

A previous paper describing the quantum theory of a laser in linear approximation is here extended to the nonlinear case. Instead of the approach of conventional theory - which deals with discrete 'cavity-modes' and includes artificial mechanisms to simulates radiation field losses due to beam extraction - a more realistic model of an optical cavity having output coupling is used that works entirely within the continuous spectrum, allowing one to obtain the equations for the field both inside and outside the laser cavity. Besides the quantum noise due to spontaneous emission, a noise term of classical nature due to transmission losses automatically emerges from the present treatment. For single-collective-mode operation the equations for laser field are solved exactly, yielding the transient and steady-state solutions. Inside the laser cavity, the results of nonlinear analysis agree with those found in conventional theory once the conventional 'mode-amplitude' is reinterpreted as a collective variable. Outside the cavity - unaccessible region in the conventional treatment - the solution for the laser field is also exhibit-

ed. Further considerations as concerning the role played by the noise terms in the field buildup are discussed.

12411 **(UFPB-DF—11/84) Laser theory in the absence of adiabatic hypothesis: linear approximation.** Penaforte, J.C.; Baseia, B. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica). 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700313.

Previous treatments of laser radiation have employed the so-called adiabatic hypothesis. Here, a quantum theory for a one-dimensional laser having output coupling is developed. The model and treatment yield exact solutions for the laser field-inside and outside the cavity - even in the absence of adiabatic hypothesis.

12412 **(UFPB-DF—12/84) Generalized Euler's formula from Poisson's summation formula and some applications.** Bezerra, V.B.; Chaba, A.N. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica). 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700314.

The generalized Euler's formula is derived from Poisson's summation formula. In special cases, it reduces to the ordinary Euler's formula and Walfisz formula in one dimension. As an application, the generalized Euler's formula is used to calculate the expression for the number of quantum states of a single non-relativistic particle in a rectangular three-dimensional box of finite size.

12413 **(UFPB-DF—17/84) Conventional Hamiltonian for first-order differential systems.** Farias, J.R. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700315.

Lagrangian systems corresponding to a given set of 2n first-order ordinary differential equations are singular ones. Despite this, it is shown that these systems can be put into a Hamiltonian form in the usual manner.

12414 **Fermions in the space-time R x S^3.** Sen, D. (Physics Department, Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213). *Journal of Mathematical Physics (New York);* **27**: No. 2, 472-482(Feb 1986). Contract AC02-76ER03066.

Quantum field theories on the surface of a four-dimensional sphere are considered. The Hamiltonian is rotation invariant and its eigenvalues are discrete. Scalar, vector, and spinorial functions on S^3 are discussed. The most general Lagrangians for Dirac, Weyl, and Majorana fermions are derived. They are different from the ones in existing literature. The wave functions and propagator are obtained and formulas for matrix elements involving spinors are presented. The discrete symmetries: parity, charge conjugation, and time reversal: are described. The Lagrangian in R x S^3 transforms in a nontrivial way under these. Finally, the fermionic Lagrangian is rederived using the tetrad formalism, and conformal transformations are discussed. This leads to a generalization of the formalism to a time-dependent radius of curvature. As a particular case, a new Lagrangian for de Sitter space is obtained, which, however, is not invariant under the full de Sitter group.

12415 **New Schroedinger equations for old: Inequivalence of the Darboux and Abraham-Moses constructions.** Luban, M.; Pursey, D.L. (Ames Laboratory-U.S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review* [*Section*] *D: Particles and Fields;* **33**: No. 2, 431-436(15 Jan 1986).

There exist two methods for generating families of isospectral Hamiltonians: one based on a theorem due to Darboux and the second due to Abraham and Moses based on the Gel'fand-Levitan equation. Both methods start with a general Hamiltonian operator $H = -d^2/dx^2 + V(x)$, and generate infinite families of new Hamiltonians all with the same eigenvalue spectrum. The new spectrum corresponds either to the addition of new bound states with specified energy eigenvalues or to the deletion of bound-state eigenvalues. Neither process (addition or deletion) alters the reflection or transmission probabilities, although the amplitudes experience a phase change consistent with Levinson's theorem and the change in the number of bound states. In this paper we show that these two methods of generating families of isospectral Hamiltonians are, in general, inequivalent.

12416 **Markov-Tree model of intrinsic transport in Hamiltonian systems.** Meiss, J.D.; Ott, E. (Institute of Fusion Studies, University of Texas, Austin, Texas 78712). *Physical Review Letters;* **55**: No. 25, 2741-2744(16 Dec 1985).

A particle in a chaotic region of phase space can spend a long time near the boundary of a regular region since transport there is slow. This "stickiness" of regular regions is thought to be responsible for previous observations in numerical experiments of a long-time algebraic decay of the particle survival probability, i.e., survival probability appt/sup -z/ for large t. This paper presents a global model for transport in such systems and demonstrates the essential role of the infinite hierarchy of small islands interspersed in the chaotic region. Results for z are discussed.

12417 **Morphology of a class of kinetic-growth models.** Savit, R.; Ziff, R. (Department of Physics, The University of Michigan, Ann Arbor, Michigan 48109). *Physical Review Letters;* **55**: No. 23, 2515-2518(2 Dec 1985). Contract FG02-85ER45189.

We study a class of local probabilistic growth processes that includes the kinetic-growth algorithm for generating percolation clusters. The shapes of the growing clusters are controlled by p, the probability of growth. For p > p/sub c/, the shapes are scale invariant with time and show interesting morphological features including both smoothly curved sections and straight facets. The facets are shown to be related to the problem of directed percolation and disappear below the directed-percolation threshold. A simple random-walk model for computing the shapes of our clusters is described.

12418 **Exact dynamically convergent calculations of the frequency-dependent density response function.** Hong, J.; Lee, M.H. (Department of Physics Education, Seoul National University, Seoul 151, Korea). *Physical Review Letters;* **55**: No. 22, 2375-2378(25 Nov 1985).

A general expression for the response function is derived by the method of recurrence relations. Memory effects appear as corrections to the dynamic random-phase approximation form. The dynamic structure for the three-dimensional electron gas is calculated to third order and compared with Al data at a large wave vector. Also shown is the dynamic local-field term.

12419 **Heuristic introduction to gravitational waves.** Sandberg, V.D. (Los Alamos National Lab., NM). *AIP (American Institute of Physics) Conference Proceedings;* No. 96, 325-330(1983). (CONF-820989—).

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

The author describes in physical terms the phenomenon of gravitational waves. The philosophy of William Gilbert is used.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 12227, 12228, 12374

12420 **(LA-UR—85-4262) Hausdorff dimensions for sets with broken scaling symmetry.** Umberger, D.K.; Mayer-Kress, G.; Jen, E. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 20p. (CONF-8509203—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004731.

From International conference on dimensions and entropies in chaotic systems; Pecos River, NM, USA (11 Sep 1985).

Based on Hausdorff's original approach to fractional dimensions, we study systems which are not sufficiently characterized by their "fractal" or scaling dimension. We construct informative examples of such sets and relate them to sets observed in the context of dynamical systems. 18 refs., 5 figs.

12421 **(LA-UR—85-4265) Approach to error-estimation in the application of dimension algorithms.** Holzfuss, J.; Mayer-Kress, G. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 12p. (CONF-8509203—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004733.

From International conference on dimensions and entropies in chaotic systems; Pecos River, NM, USA (11 Sep 1985).

Three different methods for calculating the dimension of attractors are analyzed. An approach to error-estimation is presented and is used on various datasets. It is shown that in some cases the errors can become very large.

12422 **Classical response theory propagators: An illustrative example.** Holian, B.L. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **84**: No. 3, 1762-1763(1 Feb 1986).

Time-ordered exponential propagators, introduced in the derivation of classical response theory, are illustrated for the case of the driven harmonic oscillator.

12423 **Discretization methods for one-dimensional Fokker-Planck operators.** Larsen, E.W.; Levermore, C.D.; Pomraning, G.C.; Sanderson, J.G. (Los Alamos National Laboratory, P. O. Box 1663, Los Alamos, New Mexico 87545). *Journal of Computational Physics;* **61**: No. 3, 359-390(Dec 1985).

Several new numerical methods for solving a general class of linear and nonlinear 1-dimensional time-dependent Fokker-Planck equations are suggested. These methods are positive, simple to implement, and equilibrium-preserving in the sense that every equilibrium solution of the analytic equations is also an equilibrium solution of the discretized equations. The new methods are all applied to the nonlinear problem of Compton and inverse Compton scattering, and numerical results are compared. Our numerical comparison includes results from a standard technique now in use (the Chang-Cooper method), and we discuss the relationship between this technique and the new methods. In addition, we point out certain shortcomings of the Chang-Cooper technique which these new methods remedy.

70 FUSION ENERGY

12424 **Fiscal year 1986, Department of Energy authorization (magnetic fusion energy and departmental administration and supporting services activities). Volume V. Hearings before the Subcommittee on Energy Research and Production of the Committee on Science and Technology, House of Representatives, Ninety-Ninth Congress, First Session, March 8, 18, 1985.** Washington, DC; Government Printing Office (1985). 335p.

Volume V of the hearing record covers testimony given over two days on budgets for research on magnetic fusion energy and on the administration and support services of the DOE. The principal witness on the first day was Dr. Alvin Trivelpiece of DOE, who described adjustments in fusion funding that resulted from federal budget cuts. These led to delay and deferments in the program, and raised the issue of how to maintain balance in the program and still meet program goals. Trivelpiece emphasized that cuts for fusion research were consistent with other DOE reductions. Testimony on the second day came from representatives of fusion laboratories and the nuclear industry. Two appendices with additional questions and answers submitted for the record follow the testimony of the 16 witnesses.

7001 Plasma Research

REFER ALSO TO CITATION(S) 11532, 12291, 12486, 12488, 12489, 12490, 12492, 12494, 12509, 12509

12425 **(AAEC/E—592) SCORCH - a zero dimensional plasma evolution and transport code for use in small and large tokamak systems.** Clancy, B.E.; Cook, J.L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Dec 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700358.

The zero-dimensional code SCORCH determines number density and temperature evolution in plasmas using concepts derived from the Hinton and Hazeltine transport theory. The code uses the previously reported ADL-1 data library.

12426 **(CEA-CONF—7709) Soft X-ray imaging with axisymmetry microscope and electronic readout.** Sauneuf, A.; Cavailler, C.; Henry, Ph.; Launspach, J.; de Mascureau, J.; Rostaing, M. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Nov 1984. 10p. (CONF-841010—22). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750365.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

An axisymmetric microscope with 10 X magnification has been constructed; its resolution has been measured using severals grids, backlighted by an X-ray source and found to be near 25 μm. So it could be used to make images of laser driven plasmas in the soft X-ray region. In order to see rapidly those images we have associated it with a new detector. It is a small image converter tube with a soft X-ray photocathode and a P20 phosphor deposited on an optic fiber plate. The electronic image appearing on the screen is read by a CCD working in the spectral range. An electronic image readout chain, which is identical to those we use with streak cameras, then processes automatically and immediatly the images given by the microscope.

12427 **(CEA-CONF—7792) Works on laser-matter interaction program at the Limeil-Valenton center.** Berthier, E.; Bosca, G.; Buresi, E. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Sep 1984. 11p. (In French). (CONF-840910—29; IAEA-CN—44-B-1-5). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750359.

From 10. international conference on plasma physics and controlled nuclear fusion research; London, UK (12 Sep 1984).

The experimental works on laser interaction and laser implosion at Limeil have been made with both of the power lasers P 102 (giving a target 20 J at lambda = 0,35μm) and octal (360 J in 280 ps and 900 J in 900 ps at lambda = 1,06 μm). Experiments on plane targets allowed to study the spatial modulation effect of light flux density; optical thickness of an aluminium plasma has been measured with the help of a particular geometry target. In microballoon implosion experiments, a noticeable increasing of neutron emission have been verified when the target was recovered with high density and Z coating on the theoretical side, a particular attention have been given to interaction (resonant absorption saturation mechanisms, linear theory of Raman and two-plasmon effect, stimulated Brillouin scattering saturation), to transport (plasma expansion at two electron temperature, self-consistent description of thermal and suprathermal electrons) and to the physics out of HETL.

12428 **(CONF-851102—52) ICRF antenna and feedthrough development at ORNL.** Baity, F.W.; Bryan, W.E.; Hoffman, D.J.; Owens, T.L.; Rettig, C.L.; Schechter, D.E. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004765.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

The rf technology program at Oak Ridge National Laboratory is highlighted. Simply stated, the objective of the program is to develop the technology for ion cyclotron range of frequencies heating of the fusion machines leading up to a reactor. Results from

an investigation of the importance of current strap shaping in compact antenna design are presented. Designs of the Doublet III-D and Advanced Toroidal Facility compact loop launchers are described, as are the vacuum feedthroughs for the West German tokamak TEXTOR and the Tandem Mirror Experiment Upgrade (TMX-U).

12429 **(CONF-851102—55) Physics parameter space of tokamak ignition devices.** Selcow, E.C.; Peng, Y.K.M.; Uckan, N.A.; Houlberg, W.A. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004779.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

This paper describes the results of a study to explore the physics parameter space of tokamak ignition experiments. A new physics systems code has been developed to perform the study. This code performs a global plasma analysis using steady-state, two-fluid, energy-transport models. In this paper, we discuss the models used in the code and their application to the analysis of compact ignition experiments. 8 refs., 8 figs., 1 tab.

12430 **(DOE/DP/40200—02-Vol.22) [Laser energetics quarterly report, January-March 1985]. Volume 22.** Kim, H. (ed.). (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1985. Contract FC08-85DP40200. 62p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004929.

The review reports progress of experiments in laser fusion. Topics which are included are listed below: (1) Frequency conversion of all 24 beams of the OMEGA System from ir to uv, (2) a method for measuring the temperature and the density-thickness product of an imploded target, (3) measurements of soft x-ray emission from plasmas of high-Z materials, (4) thermal transport and target implosion experiments are examined with ionic rate-equation radiation transfer analysis, (5) development of synchronously pumped, colliding-pulse, mode-locked dye laser, (6) development of instrument for testing relative adhesive strength of specimens, and (7) electro-optic sampling to characterize devices such as MESFET's and TEGFET's. 66 refs., 34 figs. (WRF)

12431 **(DOE/ER/51089—T1) Confinement by axisymmetric mirror configuration. Quarterly progress in STM program, July-September 1985.** (TRW, Inc., Redondo Beach, CA (USA)). Oct 1985. Contract AC03-85ER51089. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86002494.

The hot ion plasma in STM was characterized along the following lines: (1) Sources of error in charge exchange measurements were identified and eliminated. (2) Systematic measurements of macroscopic parameters were made. (3) A trend toward saturation in B was identified. (4) Measurements of degradation in confinement of ICRF power were made. (5) Neutral hydrogen species ratios were measured. Instabilities in the rf heated plasma were observed by observing fluctuations in light emission, microwave transmission, Langmuir probe current, and probe floating potential. 16 figs. (WRF)

12432 **(DOE/ET/53088—198) Renormalized turbulence theory of ion pressure gradient driven drift modes.** Hong, B.G.; Choi, D.I.; Horton, W. Jr. (Texas Univ., Austin (USA); Korea Advanced Inst. of Science and Technology, Seoul (Republic of Korea)). Nov 1985. Contract FG05-80ET53088. 23p. (IFSR—198). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004561.

From the nonlinear gyrokinetic equation we formulate the renormalized turbulence equation for the eta/sub i/-mode drift wave instability. The study shows that the dominant nonlinear damping mechanism is from the E x B convection of the pressure fluctuation and that the kinetic modifications to the fluid E x B mode coupling, studied earlier, shift the spectrum toward the shorter wavelengths. Balancing the linear growth rate with the nonlinear dampling rate at the linearly most unstable region, we calculate the anomalous ion thermal conductivity which exceeds the neoclassical plateau formula and gives a value of the same order as that previously computed by Horton, Choi and Tank, but with a kinetic enhancement factor. Also, the thermal conductivity formula remains finite for vanishing density gradient. 23 refs.

12433 **(DOE/ET/53088—202) Effect of toroidicity during lower hybrid mode conversion.** Riyopoulos, S.; Mahajan, S. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Nov 1985. Contract FG05-80ET53088. 23p. (IFSR—202). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005399.

The effect of toroidicity during lower hybrid mode conversion is examined by treating the wave propagation in an inhomogeneous medium as an eigenvalue problem for ω^2(m,n),m,n poloidal and toroidal wave numbers. Since the frequency regime near $\omega^2 = \omega$/sub LH/^{2} is an accumulation point for the eigenvalue spectrum, the degenerate perturbation technique must be applied. The toroidal eigenmodes are constructed by a zeroth order superposition of monochromatic solutions with different poloidal dependence m, thus they generically exhibit a wide spectrum in k/sub parallel/ for given fixed ω^2 even for small inverse aspect ratio ϵ. In case that the average <k/sub parallel/> is in the neighborhood of k/sub min/, the minimum wave number for accessibility of the mode conversion regime, it is expected that excitation of toroidal modes rather than geometric optics will determine the wave coupling to the plasma.

12434 **(DOE/ET/53088—212) Spontaneous symmetry breaking and neutral stability in the noncanonical Hamiltonian formalism.** Morrison, P.J.; Eliezer, S. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Oct 1985. Contract FG05-80ET53088. 36p. (IFSR—212). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004562.

The noncanonical Hamiltonian formalism is based upon a generalization of the Poisson bracket, a particular form of which is possessed by continuous media fields. Associated with this generalization are special constants of motion called Casimirs. These are constants that can be viewed as being built into the phase space, for they are invariant for all Hamiltonians. Casimirs are important because when added to the Hamiltonian they yield an effective Hamiltonian that produces equilibrium states upon variation. The stability of these states can be ascertained by a second variation. Goldstone's theorem, in its usual context, determines zero eigenvalues of the mass matrix for a given vacuum state, the equilibrium with minimum energy. Here, since for fluids and plasmas the vacuum state is uninteresting, we examine symmetry breaking for general equilibria. Broken symmetries imply directions of neutral stability. Two examples are presented: the nonlinear Alfven wave of plasma physics and the Korteweg-de Vries soliton. 46 refs.

12435 **(DOE/ET/53088—214) Electromagnetic solitary vortices in rotating plasma.** Liu, J.; Horton, W. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Dec 1985. Contract FG05-80ET53088. 36p. (IFSR—214). NTIS, PC A03/MF A01; GPO Dep. File Number DE86005400.

The nonlinear equations describing drift-Alfven solitary vortices in a low β, rotating plasma are derived. Two types of solitary vortex solutions along with their corresponding nonlinear dispersion relations are obtained. Both solutions have the localized coherent dilopar structure. The first type of solution belongs to the family of the usual Rossby or drift wave vortex, while the second type of solution is intrinsic to the electromagnetic perturbation in a magnetized plasma and is a complicated structure. While the first type of vortex is a solution to a second order differential equation the second one is the solution of a fourth order differential equation intrinsic to the electromagnetic problem. The fourth order vortex solution has two intrinsic space scales in contrast to the single space scale of the previous drift vortex solution. With the second short scale length the parallel current density at the vortex interface becomes continuous. As special cases the rotational electron drift vortex and the rotational ballooning vortex also are given. 10 refs.

12436 **(DOE/ET/53088—216) Existence and calculation of sharp boundary MHD equilibrium in three-dimensional toroidal geometry.** Berk, H.L.; Freidberg, J.P.; Llobet, X.; Morrison, P.J.; Tataronis, J.A. (Texas Univ., Austin (USA)). Nov 1985. Contract FG05-80ET53088. 28p. (IFSR—216). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004563.

The problem of sharp boundary, ideal magnetohydrodynamic equilibria in three-dimensional toroidal geometry is addressed.

The sharp boundary, which separates a uniform pressure, current-free plasma from a vacuum, is determined by a magnetic surface of a given vacuum magnetic field. The pressure balance equation has the form of a Hamilton-Jacobi equation with a Hamiltonian that is quadratic in the momentum variables, which are the two covariant components of the magnetic field on the outer surface of the plasma. The condition of finding a unique solution on the outer surface is identical with finding phase space tori in nonlinear dynamics problems and the KAM theorem guarantees that such solutions exist. When tori exist, renormalized perturbation theory is used to calculate the properties of the magnetic field just outside the plasma.

12437 **(DOE/ET/53088—218) Dynamics and fluctuation spectra of electrostatic resistive interchange turbulence.** Sydora, R.D.; Leboeuf, J.N.; An, Z.G.; Diamond, P.H.; Lee, G.S.; Hahm, T.S. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Nov 1985. Contract FG05-80ET53088. 37p. (IFSR—218). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004564.

The saturation mechanism for density and potential fluctuation spectra which evolve from linearly unstable electrostatic resistive interchange modes, are investigated using particle simulations. Detailed comparisons of the nonlinear evolution, saturation levels and resultant spectra between two- and three-dimensional sheared magnetic field configurations are made. Significant differences appear. The single rational surface, quasilinear-dominated evolution, fluctuation spectrum is adequately described using a density convection model. For the multiple rational surface case, the potential fluctuations are adequately represented by a balance between the nonlinearly modified source (curvature drive) and linear sink (parallel resistive field line diffusion). An accurate description of the density spectrum requires a mode coupling theory based on the two-point density correlation evolution equation. 24 refs., 15 figs.

12438 **(DOE/ET/53088—219) Destabilization of MHD modes with finite Larmor radius effects in tandem mirrors.** Kotschenreuther, M.; Berk, H.L. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jan 1986. Contract FG05-80ET53088. 20p. (IFSR—219). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005401.

Difficulties in the stabilization of ideal magnetohydrodynamic (MHD) ballooning modes by finite Larmor radius (FLR) effects are considered, in tandem mirror geometry for azimuthal mode numbers $l > 1$. A kinetic formalism is used to obtain corrections to the long thin approximation, when keeping terms of quadratic order in the curvature. If eta/sub i/ = ∂lnT/sub i/∂lnn/sub i/ ≧ 0, with T/sub i/, n/sub i/, the ion temperature and density, ion resonance effects eliminate absolute FLR stability, though the residual growth rates are substantially reduced from the MHD values. Even lowest order FLR stability is difficult to achieve with choke coils present, but is possible with a more gradually tapered mirror. However, the residual modes are still important, and mixing length estimates of the confinement degradation from modes with $l > 1$ indicate they can still severely limit the achievement of reactor-grade operation near and above the threshold beta value predicted from the ideal MHD theory. This is most severe if the ion temperature gradient decreases radial (eta/sub i/ > 0), whereupon significant instabilities can even arise below the ideal threshold. However, if the ion temperature gradient can be made positive, and -eta/sub i/ < 2/3, the lowest order FLR theory suffices to produce stability. 9 refs., 1 fig.

12439 **(GA-A—18149) Review of electron cyclotron heating experiments in toroidal devices.** Prater, R. (GA Technologies, Inc., San Diego, CA (USA)). Nov 1985. Contract AC03-84ER51044. 31p. (CONF-8509192—5). NTIS, PC A03/MF A01; GPO Dep. File Number DE86004851.

From Course and workshop on applications of RF waves to tokamak devices; Varenna, Italy (5 Sep 1985).

A review of electron cyclotron heating (ECH) experiments in tokamaks and stellarators is presented. ECH has the desirable properties of easily controlled, highly localized absorption, insensitivity to plasma boundary conditions, and high power density. The behavior of electron cyclotron waves is described by well developed theory, and experimenal determinations of absorption and propagation tend to support the theory. Global energy confinement scalings suggest that the confinement deterioration with increasing auxiliary power found with other heating methods is also found with ECH, with some exceptions. The application of ECH to the generation of plasmas with high poloidal beta, control of MHD activity, noninductive plasma current drive, and measurement of local electron thermal conductivity is discussed. 55 refs.

12440 **(GA-A—18241) Stability of electron cyclotron waves in the presence of strong electron cyclotron heating.** Hsu, J.Y.; Lashmore-Davies, C.N. (GA Technologies, Inc., San Diego, CA (USA); Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). Dec 1985. Contract AC03-84ER53158. 11p. (CONF-8511131—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004854.

From 5. international workshop electron cyclotron emission and electron; San Diego, CA, USA (9 Nov 1985).

This report examines the stability of the O-mode for perpendicular propagation when a certain fraction of the electrons form a hot electron ring. Also considered is the case of a sharp ring simpler to analyze and a diffuse ring which may occur under conditions of strong electron cyclotron heating. In both cases the parallel distribution of velocities is assumed to be Maxwellian. It was discovered that both distributions can be unstable to the O-mode. For the diffuse ring an estimate is made of the temperature of the background thermal plasma required to stabilize the instability. (JDB)

12441 **(IFUSP-P—503) Effect of collisions on the mechanism of isotope separation by ion-cyclotron waves.** Ferrari Junior, N.F.; Galvao, R.M.O. (Sao Paulo Univ. (Brazil). Inst. de Fisica). 1984. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86700360.

An expression for the ponderomotive force due to ion-cyclotron waves propagating in a collisional plasma is derived. Using this expression, the effect of collisions on the isotope separation induced by large-amplitude cyclotron waves in a two-ion-species plasma is calculated. It is shown that efficient isotope separation can still be achieved even in the evanescent propagation region.

12442 **(ORNL/FEDC—85/6) Features of spherical torus plasmas.** Peng, Y.K.M.; Strickler, D.J. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004642.

The spherical torus is a very small aspect ratio ($A < 2$) confinement concept obtained by retaining only the indispensable components inboard to the plasma torus. MHD equilibrium calculations show that spherical torus plasmas with safety factor $q > 2$ are characterized by high toroidal beta (β/sub t/ > 0.2), low poloidal beta (β/sub p/ < 0.3), naturally large elongation ($\kappa \geq 2$), large plasma current with I/sub p//(aB/sub t0/) up to about 7 MA/mT, strong paramagnetism (B/sub t//B/sub t0/ > 1.5), and strong plasma helicity (F comparable to Θ). A large near-omnigeneous region is seen at the large-major-radius, bad-curvature region of the plasma in comparison with the conventional tokamaks. These features combine to engender the spherical torus plasma in a unique physics regime which permits compact fusion at low field and modest cost. Because of its strong paramagnetism and helicity, the spherical torus plasma shares some of the desirable features of spheromak and reversed-field pinch (RFP) plasmas, but with tokamak-like confinement and safety factor q. The general class of spherical tori, which includes the spherical tokamak ($q > 1$), the spherical pinch ($1 > q > 0$), and the spherical RFP ($q < 0$), have magnetic field configurations unique in comparison with conventional tokamaks and RFPs. 22 refs., 12 figs.

12443 **(ORNL/TM—9688) Effects of an alpha particle slowing-down distribution on tokamak ballooning modes.** Spong, D.A.; Hastings, D.E.; Sigmar, D.J.; Cooper, W.A. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004647.

Energetic trapped alpha particles interact through their precessional drift with high-mode-number ballooning modes in to-

kamaks. Due to the energy dependence of the precessional drift, the consequences of this interaction depend on the form of the alpha distribution function. Results are compared here for two forms of alpha distribution: a Maxwellian and a slowing-down distribution. The latter has a significantly greater influence on ballooning stability because of the larger fraction of particles in the energy range of the drift resonance. Also, due to the dependence on the critical velocity (α T/sub e/sup 1/2/), the stability boundaries and growth rates now are strong functions of the background electron temperature T/sub e/. Parameters typical of tokamak breakeven experiments such as the Tokamak Fusion Test Reactor (TFTR) are considered. 7 refs., 7 figs.

12444 **(ORNL/TM—9704) Comparative measurement of the neutral density and particle confinement time in EBT.** Glowienka, J.C.; Richards, R.K. (Oak Ridge National Lab., TN (USA)). Nov 1985. Contract AC05-84OR21400. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004645.

The neutral density and particle confinement time in the ELMO Bumpy Torus-Scale Experiment (EBT-S) have been determined by two different techniques. These involve a spectroscopic measurement of molecular and atomic hydrogen emissions and a time-decay measurement of a fast-ion population using a diagnostic neutral beam. The results from both diagnostics exhibit identical trends for either estimate, although the absolute values differ by a factor of 2 to 3. The observed variations with fill gas pressure and microwave power from either technique are consistent with measurements of electron density and temperature. In this paper, the measurement techniques are discussed, and the results are compared in the context of consistency with independently observed plasma behavior. 6 refs., 7 figs.

12445 **(ORNL/TM—9772) Transmission measurements of selected liquids in the far infrared.** Walker, M.A.; Richards, R.K.; Hutchinson, D.P. (Oak Ridge National Lab., TN (USA)). Nov 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004641.

Measurements were taken of the transmission of 0.119 mm radiation through 22 liquids using a variable length absorption cell for the preparation of the design of an acousto-optic modulator. Seven of these liquids were then selected to be tested at wavelengths of 0.185 mm, 0.307 mm, and 0.447 mm. It was found that a light grade of mineral oil proved to have excellent transmission in the far-infrared (FIR) spectrum. We were able, from the data collected, to estimate the index of refraction of these liquids at wavelengths longer than 0.3 mm. 1 ref., 2 figs., 3 tabs.

12446 **(PFC/JA—85-37) Non-thermal electron velocity distribution measured by electron cyclotron emission in Alcator C tokamak.** Kato, K.; Hutchinson, I.H. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Oct 1985. Contract AC02-78ET51013. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004402.

The non-thermal electron velocity distribution of lower hybrid rf heated plasmas in the Alcator C tokamak is deduced from measurements of electron cyclotron emission using a specialized vertical viewing optics arrangement. At a density of anti n/sub e/ = 0.7 x $10^{20}m^{-3}$, the reconstructed distribution function in the range 50keV ≤ E ≤ 230keV shows enhancement in the parallel direction with a perpendicular spread equivalent to T/sub perpendicular/ ≈ 30keV. The line average energetic electron density in this energy range is approximately 7 x $10^{18}m^{-3}$ during the rf. 9 refs., 4 figs.

12447 **(PPPL—2248) Power balance in ELMO Bumpy Torus: bulk electrons and ions in a 37 kW discharge.** McNeill, D.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1985. Contract AC02-76CH03073. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005044.

The power balance of the bulk electrons and ions in discharges with 37 kW of applied microwave power in the ELMO Bumpy Torus (EBT) is examined in a zero-dimensional model using data on the intensity and linewidth of the molecular and atomic hydrogen emission. At least 60% of the applied power is ultimately dissipated by processes involving the neutral particles, including dissociation of molecules, ionization of and radiation from atoms, and heating of cold electrons produced during atomic ionization. The molecular influx rate and the density of atoms are used independently to determine the bulk electron particle confinement time, and an upper bound estimate is made of the diffusional power loss from the bulk plasma electrons. Parameters derived from the basic spectroscopic data presented in this paper include the neutral atom density 2 - 5x10^{10} cm^{-3}, incident molecular flux 3 - 5x10^{15} $cm^{-2}s^{-1}$, bulk ion temperature ≈3 eV, and particle confinement time <1.1 ms. The bulk electron energy confinement time is 0.7 ms or less in the standard operating regime. Published data on the nonthermal electron and ion populations in the plasma are used to evaluate approximately the overall energy flow in the discharge. 54 refs.

12448 **(PPPL—2264) Some effects of MHD activity on impurity transport in the PBX tokamak.** Ida, K.; Fonck, R.J.; Hulse, R.A.; LeBlanc, B. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1985. Contract AC02-76CH03073. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005037.

The effects of MHD activity on intrinsic impurity transport are studied in ohmic discharges of the Princeton Beta Experiment (PBX) by measuring of the Z/sub eff/ profile from visible bremsstrahlung radiation and the spectral line intensities from ultraviolet spectroscopy. A diffusive/convective transport model, including an internal disruption model, is used to simulate the data. The Z/sub eff/ profile with no MHD activity is fitted with a strong inward convection, characterized by a peaking parameter c/sub v/ (= - a^2v/2rD) = 11 (3.5, +4.5). At the onset of MHD activity (a large m = 1 n = 1 oscillation followed by sawteeth), this strongly peaked profile is flattened and subsequently reaches a new quasi-equilibrium shape. This profile is characterized by reduced convection [c/sub v/ = 3.6 (-1.1, +1.6), D = 1.4 (-0.7, +5.6) x 10^4 cm^2/s], in addition to the particle redistribution which accompanies the sawtooth internal disruptions. 10 figs.

12449 **(PPPL—2265) Feedback control of resistive instabilities.** White, R.B.; Rutherford, P.H.; Furth, H.P.; Park, W.; Chen, L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1985. Contract AC02-76CH03073. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005040.

Resistive instabilities are responsible for much of the global behavior and the determination of the possible domains of operation of tokamaks. Their successful control could have definite advantages, even making available new regimes of operation. Elimination of sawtoothing might allow operation with higher currents and more peaked current profiles, with q on axis well below unity. In this work different feedback schemes are explored. Simple analytical derivations of the effects of local heating and current drive feedback are presented. Although control of modes with m ≧ 2 is fairly straightforward, the control of the m = 1 mode is more difficult because of its proximity to ideal instability. The most promising scheme utilizes high energy trapped particles. 20 refs., 3 figs.

12450 **(PPPL—2267) Comments on "theory of dissipative density-gradient-driven turbulence in the tokamak edge" [Phys. Fluids 28, 1419 (1985)].** Krommes, J.A. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1985. Contract AC02-76CH03073. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005041.

The author critiques the model of tokamak edge turbulence by P.W. Terry and P.H. Diamond (Phys. Fluids 28, 1419, 1985). The critique includes a discussion of the physical basis, consistency and quantitative accuracy of the Terry-Diamond model. 19 refs. (WRF)

12451 **(PPPL—2281) Equilibrium fluctuation energy of gyrokinetic plasma.** Krommes, J.A.; Lee, W.W.; Oberman, C. (California Univ., Santa Barbara (USA). Inst. for Theoretical Physics; Princeton Univ., NJ (USA). Plasma Physics Lab.; California Univ., San Diego, La Jolla (USA). Dept. of Physics). Nov 1985. Contract AC02-76CH03073. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005036.

The thermal equilibrium electric field fluctuation energy of the gyrokinetic model of magnetized plasma is computed, and found to be smaller than the well-known result $<\delta E \delta E>(k)/8\pi = 1/2T/[1 + (k\lambda/\text{sub } D/)^2]$ valid for arbitrarily magnetized plasmas. It is shown that, in a certain sense, the equilibrium electric field energy is minimum in the gyrokinetic regime. 13 refs., 2 figs.

12452 **(PPPL—2286) Low-n shear Alfven spectra in axisymmetric toroidal plasmas.** Cheng, C.Z.; Chance, M.S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1985. Contract AC02-76CH03073. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005042.

In toroidal plasmas, the toroidal magnetic field is nonuniform over a magnetic surface and causes coupling of different poloidal harmonics. It is shown both analytically and numerically that the toroidicity not only breaks up the shear Alfven continuous spectrum, but also creates new, discrete, toroidicity-induced shear Alfven eigenmodes with frequencies inside the continuum gaps. Potential applications of the low-n toroidicity-induced shear Alfven eigenmodes on plasma heating and instabilities are addressed. 17 refs., 4 figs.

12453 **(PPPL—2290) Fokker-Planck and quasilinear codes.** Karney, C.F.F. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1985. Contract AC02-76CH03073. 78p. (CONF-8509162—7). NTIS, PC A05/MF A01; GPO Dep. File Number DE86005032.

From 3. European workshop on problems in the numerical modeling of plasmas; Varenna, Italy (10 Sep 1985).

The interaction of radio-frequency waves with a plasma is described by a Fokker-Planck equation with an added quasilinear term. Methods for solving this equation on a computer are discussed. 40 refs., 12 figs., 3 tabs.

12454 **(PPPL—2291) Accessibility of second regions of stability in tokamaks.** Manickam, J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1985. Contract AC02-76CH03073. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005043.

Second regions of stability to the ideal ballooning modes have been shown to exist in large-aspect-ratio circular and small-aspect-ratio bean-shaped tokamaks. We report on the existence of these second stability regions in finite-aspect-ratio dee-shaped tokamaks. We also report on the discovery of a second-stable region with respect to the n = 1 external kink mode in a bean-shaped plasma. The role of the shear and current profile in determining these regions of parameter space are discussed. 13 refs., 6 figs.

12455 **(UCRL—92514) Electrical configuration for magnetic drift pumping on the tandem mirror experiment-upgrade (TMX-U).** Jackson, M.C.; Kane, R.J.; Hulsey, S.D. (Lawrence Livermore National Lab., CA (USA)). 11 Nov 1985. Contract W-7405-ENG-48. 5p. (CONF-851102—61). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005082.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

Magnetic drift pumping on TMX-U involves driving four antennae through high Q-resonant circuits. One of the key elements in the resonant circuit is a variable inductor able to carry the 3500 amperes through the circuit and maintain its shape and inductance. The eight resonant circuits can be combined to feed the four antennae with one or two frequencies on each antenna, or frequency shift keying between two frequencies. Each resonant circuit is fed by two 10 to 30 kHz exciters capable of delivering 80 kW each to the circuit. Each exciter receives its power from its own adjustable 0 to 400 volt power supply. The entire system is controlled by a CAMAC control system over a fiber-optic link. The control system checks interlock status, controls "On" and "Off" status, calculates and adjusts phasing of the exciters for addition or deletion of the proper beat frequencies, and monitors operation. 3 refs., 5 figs.

12456 **(UCRL—93686) Monte Carlo particle simulation and finite-element techniques for tandem mirror transport.** Rognlien, T.D.; Cohen, B.I.; Matsuda, Y.; Stewart, J.J. Jr. (Lawrence Livermore National Lab., CA (USA)). Dec 1985. Contract W-7405-ENG-48. 10p. (CONF-8509216—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004238.

From US-Japan workshop on advanced plasma modeling; Nagoya, Japan (24 Sep 1985).

A description is given of numerical methods used in the study of axial transport in tandem mirrors owing to Coulomb collisions and rf diffusion. The methods are Monte Carlo particle simulations and direct solution to the Fokker-Planck equations by finite-element expansion. 11 refs.

12457 **(UCRL—93699) Plasma physics modeling and the Cray-2 multiprocessor.** Killeen, J. (Lawrence Livermore National Lab., CA (USA)). 1985. Contract W-7405-ENG-48. 12p. (CONF-851251—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004239.

From 7. international conference on computing methods in applied sciences and engineering; Versailles, France (9 Dec 1985).

The importance of computer modeling in the magnetic fusion energy research program is discussed. The need for the most advanced supercomputers is described. To meet the demand for more powerful scientific computers to solve larger and more complicated problems, the computer industry is developing multiprocessors. The role of the Cray-2 in plasma physics modeling is discussed with some examples. 28 refs., 2 figs., 1 tab.

12458 **Hot-electron ring formation in tokamak plasmas.** Hsu, J.Y.; Liu, C.S.; Prater, R.; Lin, S.H. (GA Technologies Inc., San Diego, California 92138). *Physics of Fluids;* **29**: No. 2, 507-511(Feb 1986). Contract AC03-84ER53158.

Energetic particles of tokamak plasmas may be preferentially heated by the second harmonic X mode. Their orbits collapse toward the low magnetic field side, where the resonance layer is placed, until the relativistic detuning moves the resonance layer outside the particle orbit. The time evolution of the heating process and the ring structure are presented.

12459 **Multichordal charge exchange recombination spectroscopy on the Doublet III tokamak.** Seraydarian, R.P.; Burrell, K.H.; Brooks, N.H.; Groebner, R.J.; Kahn, C. (GA Technologies Inc., San Diego, California 92138). *Review of Scientific Instruments;* **57**: No. 2, 155-163(Feb 1986). Contract AC03-84ER51044.

An instrument has been developed to spectroscopically measure ion temperature and rotation speed spatial profiles in neutral-beam-heated tokamak plasmas. Up to eight spatial chords of data can be obtained for 32 time slices during a single discharge with selectable resolution times as short as 2 ms. A special arrangement of fiber optics allows simultaneous data acquisition from all chords without the use of scanning mirrors or other moving parts. Techniques used to analyze the data from the system are discussed.

12460 **Neoclassical transport fluxes in the plateau regime in nonaxisymmetric toroidal plasmas.** Shaing, K.C.; Hirshman, S.P.; Callen, J.D. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids;* **29**: No. 2, 521-526(Feb 1986). Contract AC05-84OR21400.

The neoclassical fluxes in the plateau regime in an arbitrary large aspect ratio nonaxisymmetric toroidal system are calculated using fluid equations. The results are evaluated explicitly for a stellarator and for a rippled tokamak. For typical stellarator parameters, the helical magnetic field contribution to the particle and heat fluxes is comparable to the toroidicity contribution, and therefore, cannot be neglected. In addition, the helical magnetic field contribution to the parallel viscosity is capable of reversing the directions of the bootstrap current and Ware pinch flux in the plateau regime. In contrast, the neoclassical particle and heat fluxes in a rippled tokamak are comparable to those in an axisymmetric tokamak after the radial electric field and parallel flow velocity are determined (without external sources).

12461 **Bifurcation phenomena and the radial electric field in a nonaxisymmetric plasma.** Hastings, D.E. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids;* **29**: No. 2, 536-543(Feb 1986). Contract AC05-84OR21400.

The radial electric field in a nonaxisymmetric plasma is known to be a multivalued function of the plasma state. It is shown that the theorem of minimum entropy production rate cannot be used to distinguish between different electric field solutions. The possibility of bifurcation phenomena in the coupled electric field, density, and temperature equations are examined. It is shown that the functional dependence of the plasma source can strongly influence the type of bifurcation that can occur.

12462 **q = 2 sawteeth and major disruptions in tokamaks.** Kleva, R.G.; Drake, J.F.; Boyd, D.A. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **29**: No. 2, 475-482(Feb 1986).

In numerical simulations of q = 2 tearing modes, the maximum amplitude of the mode is found to increase rapidly as the safety factor on axis q(0) rises above 1.5. The associated magnetic islands grow to the center of the column, encompassing virtually the entire plasma cross section. As a result of the formation of these very large islands, the hot central plasma is rapidly convected out to the edge of the column, thereby destroying central confinement. Experimental evidence from several tokamaks linking the formation of these very large islands with major disruptions is presented. Typically, major disruptions are observed to occur in two (or more) stages. During the first stage(s) q rises on axis while the final stage, which terminates the discharge, is associated with the violent growth of an m = 2 perturbation. Under some circumstances q = 2 sawteeth are predicted to occur. Evidence for such sawteeth in a divertor tokamak is discussed.

12463 **Linear studies of resistive interchange modes in a cylindrical reversed field pinch.** Mirin, A.A.; O'Neill, N.J.; Killeen, J.; Bonugli, R.J.; Ellis, M.J. (National Magnetic Fusion Energy Computer Center, Lawrence Livermore National Laboratory,Livermore, California 94550). *Physics of Fluids;* **29**: No. 2, 512-520(Feb 1986). Contract W-7405-ENG-48.

Resistive interchange modes in a cylindrical reversed field pinch are studied using a one-dimensional, linear, compressible initial value code. Separate equations for the electron and ion temperature perturbations are solved. Hall terms and the thermal force vector are included in Ohm's law. Anisotropic thermal conductivity and viscosity are included in the code model. Calculations are carried out for various values of poloidal and toroidal mode number, Lundquist number, Suydam parameter, Hall parameter, thermal conductivity, viscosity, etc., with respect to uniform density equilibria known to be stable to tearing modes. It is shown that in the cold ion limit sufficiently large Hall terms cause all modes that are tested to become stable. However for T/sub i/ = T/sub e/ and ignoring the effects of viscosity and thermal conductivity, there is a critical value of the ratio of Alfven to ion cyclotron frequency above which the "even" mode not only dominates the "odd" mode but is likely to have a growth rate significantly larger than that of the odd mode in the absence of Hall terms. Inclusion of a classical tensor thermal conductivity, while having little effect on the odd mode in the absence of Hall terms, does stabilize the even mode for sufficiently large Hall parameter. Inclusion of a classical tensor viscosity reduces the growth rate of (but does not necessarily stabilize) the odd mode. Inclusion of Hall and thermal force terms, tensor thermal conductivity and tensor viscosity causes all modes that are tested to stabilize. Results are compared to other contemporary studies.

12464 **Acceleration of beam ions during major-radius compression in the tokamak fusion test reactor.** Wong, K.L.; Bitter, M.; Hammett, G.W.; Heidbrink, W.; Hendel, H.; Kaita, R.; Scott, S.; Strachan, J.D.; Tait, G.; Bell, M.G. (Princeton Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physical Review Letters;* **55**: No. 23, 2587-2590(2 Dec 1985). Contract AC02-76CH03073.

Tangentially coinjected deuterium beam ions were accelerated from 82 up to 150 keV during a major-radius compression experiment in the tokamak fusion test reactor. The ion energy spectra and the variation in fusion yield were in good agreement with Fokker-Planck code simulations. In addition, the plasma rotation velocity was observed to rise during compression.

12465 **Observation of large amplitude, narrow-band density fluctuations in the interior region of an Ohmic tokamak plasma.** Brower, D.L.; Peebles, W.A.; Luhmann N.C. Jr. (University of California at Los Angeles, Los Angeles, California 90024). *Physical Review Letters;* **55**: No. 23, 2579-2582(2 Dec 1985). Contract AC05-78ET53043.

Strong spatial asymmetries in the spectrum and magnitude of low-frequency ($\omega << \omega$/sub c/i) density fluctuations have recently been measured in the TEXT tokamak. Large amplitude, narrow-band (as low as $\Delta\omega/\omega \approx 0.1$) modes have been observed on the high-field torus inside in addition to the typical broad-band ($\Delta\omega/\omega \approx 1$) microturbulence which is present throughout the plasma cross section. These narrow-band fluctuations are only detected at the plasma interior, being localized towards the midplane, and are not seen at the edge.

12466 **Inductance effect of runaways on lower-hybrid-current ramping.** Liu, C.S.; Chan, V.S.; Lee, Y.C. (GA Technologies Inc., San Diego, California 92138). *Physical Review Letters;* **55**: No. 23, 2583-2586(2 Dec 1985). Contract AC03-84ER53158.

The role of runaway electrons in current ramping by lower-hybrid waves is discussed. The back emf induced by lower-hybrid-current ramping produces runaway electrons at a rate n/sub R/ such that the additional inductance (proportional to n/sub R/ec) can be significant in opposing the current ramping. However, runaway electrons can also destabilize the oblique plasma waves through their anisotropy. The resulting turbulence can greatly reduce the runaway production rate, enabling the current-ramping rate to exceed the above limit.

12467 **Electromagnetic wave propagation in relativistic magnetized plasmas.** Weiss, I. (Massachusetts Institute of Technology, Plasma Fusion Center, Cambridge, Massachusetts 02139). *Journal of Computational Physics;* **61**: No. 3, 403-416(Dec 1985). Contract AC02-76ER03077.

An improved mathematical technique and a new code for deriving the conductivity tensor for collisionless plasmas have been developed. The method is applicable to a very general case, including both hot (relativistic) and cold magnetized plasmas, with only isotropic equilibrium distributions being considered here. The usual derivation starts from the relativistic Vlasov equation and leads to an integration over an infinite sum of Bessel functions which has to be done numerically. In the new solution the integration is carried out over a product of two Bessel functions only. This reduces the computing time very significantly. An added advantage over existing codes is our capability to perform the computations for waves propagating obliquely to the magnetic field. Both improvements greatly facilitate investigations of properties of the plasma under conditions hitherto unexplored.

12468 **Long-time impurity confinement as a precursor to disruptions in ohmically heated tokamaks.** Isler, R.C.; Rowan, W.L.; Hodge, W.L. (Fusion Energy Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review Letters;* **55**: No. 22, 2413-2416(25 Nov 1985). Contract AC05-78ET53043.

The confinement times of impurities in ohmically heated tokamaks are shown to lengthen considerably as the density-limit boundary is approached and exceeded either by increasing n/sub e/ itself or by lowering B/sub T/ or I/sub p/. Observations made on the Texas Tokamak indicate that a change in the balance of diffusion and inward convection mechanisms governing impurity transport precedes the onset of partial or major disruptions. These studies also explain the reason for the wide differences of impurity behavior previously observed among various tokamaks.

12469 **Comparison of the radial potential profile measured in a tokamak to predictions of stochastic magnetic field theory.** Schoch, P.M.; Hickok, R.L.; Jennings, W.C. (Rensselaer Polytechnic Institute, Troy, New York 12181). *Physical Review Letters;* **55**: No. 22, 2417-2420(25 Nov 1985). Contract AC02-76ET53004.

A space potential distribution which is positive at all radii has been measured in the research tokamak RENTOR. This is in sharp contrast to negative potential wells observed in other devices. The positive potential distribution is in qualitative agreement with the predictions of stochastic magnetic field theory.

12470 **Accelerator-based plasma-wall interaction studies on the TEXTOR tokamak.** Zuhr, R.A. (Oak Ridge National Lab., TN, USA. Solid State Div.). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 467-472(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Also published as CONF-841117--51.

Deposition probes are commonly used to determine plasma edge characteristics in tokamaks. Such probes are frequently analyzed using accelerator-based techniques and can yield information on impurity fluxes, hydrogen fluxes and energies, and surface erosion rates in the plasma edge. Several types of deposition probes have been employed to investigate the plasma edge region of the TEXTOR tokamak in Juelich, FRG. TEXTOR is a moderate size tokamak (major radius = 1.75 m) that is capable of 2-3 s discharges and contains a liner that can be heated to 600°C. These capabilities make TEXTOR particularly attractive for the study of plasma-wall interactions. Several countries, including the United States, Sweden and the host nation, are carrying on active research programs in the area of plasma edge studies. This research has included measurements of plasma, impurity, and power fluxes at various radii in the scrapeoff layer. The results achieved in characterizing the plasma edge in these recent probe studies on TEXTOR will be reviewed.

12471 **Accelerator-based diagnostics in tandem-mirror fusion experiments.** Bastasz, R.; Hsu, W.L.; Pontau, A.E.; Wilson, K.L. (Sandia National Labs., Livermore, CA, USA). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 487-491(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Several accelerator-based analysis techniques have proven useful in diagnosing plasma-edge and first-wall conditions in two tandem-mirror fusion experiments. This paper describes the various techniques and the use of solid-state probes in the tandem-mirror devices TMX and TMX-U in conjunction with subsequent analysis by Rutherford backscattering spectrometry (RBS), nuclear reaction analysis (NRA), and secondary ion mass spectrometry (SIMS). RBS was used to measure the concentration of deposited impurities on solid-state probe samples. NRA, utilizing the D(^{3}He, α)H reaction, gave quantitative data about deuterium retention levels in carbon samples exposed to the plasma. SIMS analysis produced near-surface depth profiles of implanted deuterium in exposed silicon samples. Taken together, these techniques provided detailed information about impurity levels, the flux and energy of particles striking the first-wall, and plasma-edge temperatures. This information has contributed towards an understanding of the confinement properties of tandem mirrors.

12472 **(AAEC-LIB/Trans—796) Isotope separation in a rotational plasma.** Tomimura, A.; Nicoli, C. Translated from *Revista Brasileira de Fisica ;* **1**: 151-160(1985). 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86780329.

The model of a steady cascade in a plasma confined between two cylindrical electrodes and immersed in a homogenous and axial magnetic field is constructed in order to study the separation properties of the elements that make up its mono-ionised ionic species. Rotation is imposed over a column of plasma through the interaction J x B and sufficiently balanced by viscous friction. In the radial direction the pinch effect, due to the radial component of the J x B interaction, counterbalances the pressure gradient which is bigger than the centrifugal force. A uranium gas with its two principal isotopes (U^{235} and U^{238}) constitutes an ionic species of plasma. The numerical scheme designed to resolve the system of equations containing variables of density, temperature and velocity as a function of the radius promises solutions that satisfy null contour conditions for velocity in the two contours (external and internal electrodes). Maximum typical values of velocity and separation factor at temperatures and densities (in the internal electrode) of the order of 60,000 K and 5 x 10^{15} cm^{-3} are, for example, 11.8 km/s and 1.4 respectively. Bigger values can be obtained, depending on the values of the free parameters in the internal electrode.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 11515, 11525, 11756, 11757, 12309, 12427, 12437

12473 **(ANU-PRL—84/4) Network approach to large-scale experimental data acquisition and analysis.** Corbould, M.A.; How, J.A. (Australian National Univ., Canberra. Plasma Research Lab.). 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701200.

The Plasma Research Laboatory at the Australian National University has developed a sophisticated and flexible data acquisition system for its LT-4 tokamak that requires very little support to construct, maintain and expand. It is novel in that is based on a minicomputer network and is built almost entirely of commercially available products. Benchmarks show that the network system outperforms conventional stand-alone and time-shared data systems.

12474 **(CEA-CONF—7691) Irradiation of lithium aluminate and tritium extraction.** Roth, E.; Abassin, J.J.; Botter, F.; Briec, M.; Chenebault, P.; Masson, M.; Rasneur, B.; Roux, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Dec 1984. 20p. (CONF-841246—27). NTIS (US Sales Only), PC A02/MF A01. File Number DE86750354.

From 1. international conference on fusion reactor materials; Tokyo, Japan (3 Dec 1984).

After preselection of the preparation procedures, following short irradiations, γ $LiAlO_2$ samples submitted to 2.10^{19} fast neutrons cm^{-2} and 1.5 10^{20} thermal neutrons cm^{-2} fluences experienced no apparent damage. Post-irradiation tritium extraction from samples irradiated to 2.10^{17} neutrons/cm^2 in quartz ampoules produced mostly tritiated water. When in-pile experiments are performed the sample container material influences greatly the measured ratio of tritium gas to tritiated water - Stainless steel capsules yield more T_2 gas than quartz capsules probably because of a reduction process. Difficulties in interpretation arise from adsoption of tritiated water on the measuring lines. Both experiments showed that much faster extraction rates are obtained from small grain size samples than from large ones at the same open porosity. If diffusion in the grains controls the extraction rates, apparent D values vary from 10^{-16} to 1.5 $10^{-15}cm^2S^{-1}$ in the temperature range explored. Around 500°C small grain samples reached equilibrium tritium concentration of a few mCi in 4 hours. Such values are suitable for a blanket concept.

12475 **(CEA-CONF—7821) Status report on the plasma-particle beam interaction experiment at Bruyeres-le-Chatel.** Dei-Cas, R. (California Univ., Los Angeles (USA). Dept. of Radiological Sciences). Nov 1984. 41p. (CONF-8409219—2). NTIS (US Sales Only), PC A03/MF A01. File Number DE86750376.

From 2. international workshop on atomic physics for ion fusion; Chilton, UK (11 Sep 1984).

In this report we described the present status of the experimental facility consisting of a bunched heavy ion beam, delivered by a tandem accelerator, which will travel through a laser created plasma. Preliminary tests are in progress to characterize the particle beam and to calibrate the X-ray spectrometer by using X-ray beam foil spectroscopy and the Thomson parabola spectrometer. The

CO_2 laser is in the final construction phase; the diagnostics and the data acquisition system under development are described.

12476 **(CFFTP-G—84033) Review of fusion breeder blanket technology. Part 1. Review and findings, December 1984.** Jackson, D.P.; Selander, W.N.; Townes, B.M. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Jan 1985. 308p. (AECL—8631). NTIS (US Sales Only), PC A14/MF A01. File Number DE86700361.

This report presents the results of a study of fusion breeder blanket technology. It reviews the role of the breeder blanket, the current understanding of the scientific and engineering bases of liquid metal and solid breeder blankets and the programs now underway internationally to resolve the uncertainities in current knowledge. In view of existing national expertise and experience, a solid breeder R and D program for Canada is recommended.

12477 **(CONF-851102—53) Implementation and operation of VAX-based data acquisition system for the large coil task.** Baylor, L.R.; Blair, E.T.; Greenwood, D.E.; Munro, J.K. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004767.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

The VAX-based data acquisition system for the International Fusion Superconducting Magnet Test Facility (IFSMTF) at Oak Ridge National Laboratory (ORNL) is a second generation system that evolved from a PDP-11/60-based system used in the two-coil test and facility shakedown. The VAX 11/780 processor has been interfaced through a CAMAC fiber-optic byte serial highway to five existing LSI-11/23 frontend processors through dataway access port (DAP) modules. The VAX CAMAC interface has permitted the addition of analog input channels for the refrigeration system and analog and digital outputs to drive display devices. Software utilities are provided to operate the data acquisition hardware, maintain data base files, and display data. Graphical display of data is accomplished through the use of VAX IDL (Interactive Data Language), which provides device-independent data presentation. Output from IDL is available for Tektronix displays and has been extended to generate TKF and Versaplot graphics metafiles for hardcopy output to Versatec printer/plotters. In addition, a Session display system is available for graphical display of real-time data in the form of strip chart and tabular displays. This paper describes the hardware and software design of the system and the operation of the system during the full-array testing sequence.

12478 **(CONF-851102—57) Advanced Toroidal Facility.** Johnson, R.L. (Martin Marietta Energy Systems, Oak Ridge, TN (USA)). 1985. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004805.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

The Advanced Toroidal Facility (ATF) is a new magnetic confinement plasma device under construction at the Oak Ridge National Laboratory (ORNL) that will lead to improvements in toroidal magnetic fusion reactors. The ATF is a type of stellerator, known as a "torsatron" which theoretically has the capability to operate at $\geq 8\%$ beta in steady state. The ATF plasma has a major radius of 2.1 m, an average minor radius of 0.3 m, and a field of 2 T for a 2 s duration or 1 T steady state. The ATF device consists of a helical field (HF) coil set, a set of poloidal field (PF) coils, an exterior shell structure to support the coils, and a thin, helically contoured vacuum vessel inside the coils. The ATF replaces the Impurities Studies Experiment (ISX-B) tokamak at ORNL and will use the ISX-B auxiliary systems including 4 MW of electron cyclotron heating. The ATF is scheduled to start operation in late 1986. An overview of the ATF device is presented, including details of the construction process envisioned. 9 refs., 7 figs., 3 tabs.

12479 **(CONF-851102—58) ORNL facilities for testing first-wall components.** Tsai, C.C.; Becraft, W.R.; Gardner, W.L.; Haselton, H.H.; Hoffman, D.J.; Menon, M.M.; Stirling, W.L. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 6p. NTIS, PC A02. File Number DE86004793.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

Future long-impulse magnetic fusion devices will have operating characteristics similar to those described in the design studies of the Tokamak Fusion Core Experiment (TFCX), the Fusion Engineering Device (FED), and the International Tokamak Reactor (INTOR). Their first-wall components (pumped limiters, divertor plates, and rf waveguide launchers with Faraday shields) will be subjected to intense bombardment by energetic particles exhausted from the plasma, including fusion products. These particles are expected to have particle energies of ~ 100 eV, particle fluxes of $\sim 10^{18}$ cm^{-2}s^{-1}, and heat fluxes of ~ 1 kW/cm^2 CW to ~ 100 kW/cm^2 transient. No components are available to simultaneously handle these particle and heat fluxes, survive the resulting sputtering erosion, and remove exhaust gas without degrading plasma quality. Critical issues for research and development of first-wall components have been identified in the INTOR Activity. Test facilities are needed to qualify candidate materials and develop components. At Oak Ridge National Laboratory (ORNL), existing neutral beam and wave heating test facilities can be modified to simulate first-wall environments with heat fluxes up to 30 kW/cm^2, particle fluxes of $\sim 10^{18}$ cm^{-2}s^{-1}, and pulse lengths up to 30 s, within test volumes up to ~ 100 L. The characteristics of these test facilities are described, with particular attention to the areas of particle flux, heat flux, particle energy, pulse length, and duty cycle, and the potential applications of these facilities for first-wall component development are discussed.

12480 **(CONF-851102—59) Highlights from the assembly of the helical field coils for the Advanced Toroidal Facility.** Benson, R.D. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004758.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

The helical field (HF) coils in the Advanced Toroidal Facility (ATF) device consist of a set of 24 identical segments connected to form a continuous pair of helical coils wrapped around a toroidal vacuum vessel. Each segment weighs approximately 1364 kg (3000 lb) and is composed of 14 water-cooled copper plate conductors bolted to a cast stainless steel structural support member with a T-shape cross section (known as the structural tee). The segment components are electrically insulated with Kapton adhesive tape, G-10, Tefzel, and rubber to withstand 2.5 kV. As a final insulator and structural support, the entire segment is vacuum impregnated with epoxy. This paper offers a brief overview of the processes used to assemble the component parts into a completed segment, including identification of items that required special attention. 4 figs.

12481 **(CONF-851102—60) Mechanical testing and development of the helical field coil joint for the Advanced Toroidal Facility.** Nelson, B.E.; Bryan, W.E.; Goranson, P.L.; Warwick, J.E. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 6p. NTIS, PC A02. File Number DE86005028.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

The helical field (HF) coil set for the Advanced Toroidal Facility (ATF) is an M = 12, l = 2, constant-ratio torsatron winding consisting of 2 coils, each with 14 turns of heavy copper conductor. The coils are divided into 24 identical segments to facilitate fabrication and minimize the assembly schedule. The segments are connected across through-bolted lap joints that must carry up to 124,000 A per turn for 5 s or 62,500 A steady-state. In addition, the joints must carry the high magnetic and thermal loads induced in the conductor and still fit within the basic 140- by 30-mm copper envelope. Extensive testing and development were undertaken to verify and refine the basic joint design. Tests included assembly force and clamping force for various types of misalignment; joint resistance as a function of clamping force; clamp bolt relaxation due to thermal cycling; fatigue testing of full-size, multiturn joint prototypes; and low-cycle fatigue and tensile tests of annealed CDA102 copper. The required performance parameters and actual test results, as well as the final joint configuration, are presented. 2 refs., 9 figs., 4 tabs.

12482 **(CONF-8510209—3) Configuration and structural design of Compact Ignition Tokamak.** Brown, T.G. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004783.

From U.S.-Japan next step machine design workshop at JAERI; Mito, Japan (21 Oct 1985).

Viewgraphs are presented on the configuration and structural design of the Compact Ignition Tokamak, originally presented to the US/Japan Workshop on Next Step Machine Design. Items discussed in this presentation include: PPPL 0424 ref design; MIT LITE ref design; IGNITOR 1.01 M ref design; and IGNITOR 1.08 M press configuration. (JDB)

12483 **(CONF-8510248—1) Superconducting magnet research and development program.** Lue, J.W. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86003092.

From 2. United States/Japan exchange workshop on "superconducting magnet requirements for long-pulse tokamaks"; Tokai, Japan (29 Oct 1985).

Viewgraphs for the conference presentation are given. The author reports technical progress in the research and development of cable-in-conduit internally-cooled superconductors; the design, construction and test of EBT-P magnets; the tests of Westinghouse/Airco Nb_3Sn conductors; partial-array test in IFSMTF; the evaluation of pressure taps on the Westinghouse conductor sheath; and IFSMTF vapor-cooled-lead tests. 12 figs., 1 tab. (WRF)

12484 **(CONF-8511131—2) Pure mode swept frequency TE_{02} measurements in 6.35 cm circular waveguide.** Bigelow, T.S.; White, T.L.; Kimrey, H.D. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004782.

From 5. international workshop electron cyclotron emission and electron; San Diego, CA, USA (9 Nov 1985).

A mode transducer was developed which generates high purity (>99%) TE_{02} mode in small diameter (1.64 cm) circular waveguide. The device works from 52 to 62 GHz which allows relatively wideband, accurate swept frequency measurements of insertion and return loss in this mode. TE_{01} to TE_{02} insertion loss for the device is approximately 0.2 dB and the Te_{01} mode rejection from the TE_{02} port is 15 dB. A 2-degree linear taper is used to connect to 6.35 cm diameter waveguide. Mode purity of the TE_{02} mode after this taper is >98%. Some typical measurements of waveguide components as well as a description of the device will be presented.

12485 **(DOE/DP/40124—50) Simulation of experiments in spherical irradiation at λ = 351 nm.** Delettrez, J.; Epstein, R.; Richardson, M.C.; Verdon, C.P.; Yaakobi, B. (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1984. Contract AC08-80DP40124. 12p. (CONF-841010—25). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004895.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

We present one-dimensional LILAC simulations of spherical target experiment at λ = 350 nm on the OMEGA laser system. Laser pulse parameters are 300 to 600 J in 0.6 ns and 10^{14} to 10^{15} W/cm^2 irradiance on target. Comparison will be made for the absorption fraction, implosion time, and burnthrough of the heat front in plastic coated targets. Transport results will be discussed for imploding and solid targets. 8 figs.

12486 **(DOE/DP/40124—76) Measurements of energetic electron distributions in uv and ir laser plasmas.** Keck, R.L. (Rochester Univ., NY (USA)). Jun 1985. Contract AC08-80DP40124. 121p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86004199.

Measurements have been made of the x-ray continuum produced by plasmas irradiated with 0.35 and 1.05 μm laser light over an intensity range of 5 x 10^{13} to 2 x 10^{15} W/cm^2. From the x-ray continuum, which was measured over a range of 1.5 to 300 keV, both the temperature of and fractional energy in any supra-thermal electron distributions can be obtained. The measurements show the presence of a very high temperature (20 to 60 keV) electron distribution with either 0.35 or 1.05 μm irradiation. This component, which is attributed to the presence of the two-plasmon decay instability, is observed above an intensity of approximately 10^{14} W/cm^2 at 1.05 μm and contains less than 0.1% of the incident laser energy. With 0.35 μm irradiation, the intensity at which this component is observed is approximately a factor of 3 higher. At 1.05 μm, this very high temperature component appears in addition to a third, 2 to 7 keV, component attributed to resonance absorption. 38 refs., 37 figs., 6 tabs.

12487 **(DOE/DP/40200—01-Vol.21) [Glass Development Laser (GDL) Facility upgrade.] LLE Review. Quarterly report, October-December 1984. Volume 21.** Kim, H. (ed.). (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1984. Contract FC08-85DP40200. 60p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004928.

This volume of the LLE Review contains articles on the upgrade of the GDL (Glass Development) system, theoretical advances in the laser fusion effort, improved target fabrication capabilities, x-ray laser research, developments in the picosecond optics research of the LLE advanced technology program, and on the National Laser Users Facility activities for October-December 1984. 56 refs., 31 figs., 3 tabs. (WRF)

12488 **(DOE/DP/40200—03-Vol.23) LLE Review. Quarterly report, April-June 1985.** Skupsky, S. (ed.). (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1985. Contract FC08-85DP40200. 68p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004930.

This volume of the LLE Review contains articles on the fully UV-converted OMEGA laser system, mass-ablation rate experiments, reactor-size target designs, plasma processes in the target corona, degradation in optical performance of dielectric thin films, and the National Laser Users Facility activities for April-June 1985. 65 refs., 35 figs.

12489 **(DOE/DP/40200—04-Vol.24) [Experiments on the OMEGA Laser System]. LLE Review. Quarterly report, July-September 1985. Volume 24.** Skupsky, S. (ed.). (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1985. Contract FC08-85DP40200. 67p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004931.

This volume of the LLE Review contains articles on the first 24-beam uv experiments on the OMEGA laser system, the use of absorption spectroscopy to diagnose high-density compressions, the development of a new target fabrication technique to coat mechanically unsupported laser-fusion targets with a parylene layer, the use of liquid crystals as laser-beam apodizers, the investigation of the process of melting using a subpicosecond probe, the development of a new picosecond oscilloscope, and the National Laser Users Facility activities for June-September 1985. 80 refs., 36 figs.

12490 **(DOE/DP/40200—18) Thermal transport: a comparison between solid and shell targets.** Jaanimagi, P.A.; Henke, B.L.; Barnouin, O.; Delettrez, J.; Epstein, R.; Richardson, M.C.; Yaakobi, B.; Hauer, A. (Lawrence Berkeley Lab., CA (USA); Rochester Univ., NY (USA). Lab. for Laser Energetics; Los Alamos National Lab., NM (USA)). 1985. Contract FC08-85DP40200. 18p. (CONF-851136—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004826.

From Meeting of the Plasma Physics Division of the American Physical Society; San Diego, CA, USA (4 Nov 1985).

A series of experiments have been performed on the 24-beam UV OMEGA laser system to address the issue of electron thermal transport on spherical solid and moving shell targets. Measurements of the mass ablation rate through thin CH layers on the target surface to the glass substrate were made using time-integrated and time-resolved x-ray spectroscopy. An optical fiducial on the x-ray streak camera was incorporated to measure m dot as a function of time. Comparisons are made with simulations carried out with the 1-D hydrodynamic code LILAC. 14 figs.

12491 **(DOE/ER/52082—1) Effects of radiation and high heat flux on the performance of first-wall components. Final report.** Wolfer, W.G. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). Oct 1985. Contract AC02-82ER52082. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004285.

The performance of high-heat-flux components in present and future fusion devices is strongly affected by materials properties and their changes with radiation exposure and helium content. In addition, plasma disruptions and thermal fatigue are major life-limiting aspects. A multidisciplinary approach is therefore required in the performance analysis, and the following results have been accomplished. An equation of state for helium has been derived and applied to helium bubble formation by various growth processes. Models for various radiation effects have been developed and perfected to analyze radiation-induced swelling and embrittlement for high-heat flux materials. Computer codes have been developed to predict melting, evaporation, and melt-layer stability during plasma disruptions. A structural analysis code was perfected to evaluate the stress distribution and crack propagation in a high-heat-flux component or first wall. This code was applied to a duplex structure consisting of a beryllium coating on a copper substrate. It was also used to compare the lifetimes of a first wall in a tokamak reactor made of ferritic or austenitic steel.

12492 **(DOE/ET/51013—T7) m = 1, n = 1 oscillations following the injection of a fuel pellet on the Alcator C tokamak.** Parker, J.; Greenwald, M.; Petrasso, R.; Granetz, R.; Gomez, C. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). 1985. Contract AC02-78ET51013. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004401.

Immediately following the injection of a fuel pellet, strong m = 1, n = 1 oscillations of the soft x-ray signals are sometimes observed. Measurements of the electron temperature during this period indicate that the x-ray fluctuations cannot be accounted for by temperature variations. This implies that the densities must vary. Experimental data and computer modeling support the conclusion that a coherent fluctuation of the electron-proton density and of a light impurity can account for the measured results. 14 refs., 4 figs.

12493 **(DOE/ET/52048—32) Fusion reactor physics and technology studies. Final report, October 1, 1977-November 30, 1985.** Kulcinski, G.L.; Emmert, G.A.; Maynard, C.W.; Conn, R.W.; Santarius, J.F.; Sviatoslavsky, I.N.; Sawan, M.E. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). Nov 1985. Contract AC02-78ET52048. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004527.

A brief review of seven reactor studies is given. The studies which are listed are NUWAK, INTOR, WITAMIR-I, UWTOR-M, MARS, and MINIMARS. A list of 133 reports which were issued under "Fusion Reactor Physics and Technology Studies" is given for further consideration of the above studies. (WRF)

12494 **(DOE/ET/53088—223) Muon catalyzed fusion - fission reactor driven by a recirculating beam.** Eliezer, S.; Tajima, T.; Rosenbluth, M.N. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jan 1986. Contract FG05-80ET53088. 55p. (IFSR—223). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005403.

The recent experimentally inferred value of multiplicity of fusion of deuterium and tritium catalyzed by muons has rekindled interest in its application to reactors. Since the main energy expended is in pion (and consequent muon) productions, we try to minimize the pion loss by magnetically confining pions where they are created. Although it appears at this moment not possible to achieve energy gain by pure fusion, it is possible to gain energy by combining catalyzed fusion with fission blankets. We present two new ideas that improve the muon fusion reactor concept. The first idea is to combine the target, the converter of pions into muons, and the synthesizer into one (the synergetic concept). This is accomplished by injecting a tritium or deuterium beam of 1 GeV/nucleon into DT fuel contained in a magnetic mirror. The confined pions slow down and decay into muons, which are confined in the fuel causing little muon loss. The necessary quantity of tritium to keep the reactor viable has been derived. The second idea is that the beam passing through the target is collected for reuse and recirculated, while the strongly interacted portion of the beam is directed to electronuclear blankets. The present concepts are based on known technologies and on known physical processes and data. 29 refs., 6 figs., 4 tabs.

12495 **(LA-UR—85-3988) Current operations and experiments at the Tritium Systems Test Assembly.** Bartlit, J.R.; Anderson, J.L. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 5p. (CONF-851102—56). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004718.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

The Tritium Systems Test Assembly (TSTA) has continued to move toward operation of a fully-integrated, full-sized, computer-controlled fusion fuel processing loop. Concurrent, nonloop experiments have answered important questions on new components and issues such as palladium diffusion membranes, ceramic electrolysis cells, regenerable tritium getters, laser Raman spectroscopy, unregenerable tritium inventory on molecular sieves, tritium contamination problems and decontamination methods, and operating data on reliability, emissions, doses, and wastes generated. 4 refs., 2 figs.

12496 **(LA-UR—85-4472) Model for optical-laser-induced impulse in vacuo.** Dingus, R.S.; Goldman, S.R. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 10p. (CONF-8511120—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004752.

From AIAA laser effects and target response meeting; Menlo Park, CA, USA (5 Nov 1985).

A simple model, along with its derivation, is presented for calculating the impulse from targets in a vacuum exposed to single-pulse, optical lasers. Figures demonstrate that throughout most of the range of interest, results from the model agree well with experimental data and LASNEX radiation-hydrodynamic computer code calculations. The model assumes isothermal blowoff and thus takes advantage of the insensitivity of impulse to energy distribution within the ablated mass. The density profile in the blowoff is estimated and the Saha equation is used to evaluate the degree of ionization. The laser absorption coefficient and thermal radiation opacity are evaluated as a function of position in the blowoff in order to evaluate the energy reaching the ablation surface. An overall energy balance plus an energy balance at the ablation surface are used to determine the blowoff mass and temperature. The success of the model indicates that the impulse is insensitive to detailed interactions in the vicinity of the ablation surface. 11 refs., 6 figs.

12497 **(ORNL/TM—9689) ATF neutral beam injection: optimization of beam alignment and aperturing.** Morris, R.N.; Fowler, R.H.; Rome, J.A.; Schlagel, T.J. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004638.

The application of the existing Impurity Study Experiment (ISX-B) neutral beam injectors for the Advanced Toroidal Facility (ATF) is studied. It is determined that with the practical considerations of beam aperturing, ATF vacuum vessel complexity, and realistic beam modeling, the power absorbed by the plasma will be approximately 57% of the extracted neutral beam power, which corresponds to an injected power of about 1.5 MW. By reducing the beam divergence to a 1° Gaussian distribution, the absorbed power could be increased to 93%. The power delivered to the plasma is found to be a strong function of the beam divergence but only a weak function of the beam focal length. Shinethrough can be a serious problem if very low density startups are necessary. Preliminary calculations indicate that there will be no excessive fast-ion losses. 12 refs., 17 figs., 1 tab.

12498 **(ORNL/TM—9885) Monte Carlo and discrete ordinates calculations for 14-MeV neutrons streaming through a stainless steel duct: comparisons with Experiment II.** Santoro, R.T.; Barnes, J.M.; Alsmiller, R.G. Jr.; Drischler, J.D. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004640.

Measured and calculated neutron energy spectra from 14-MeV neutrons streaming through stainless steel ducts having length-to-diameter raios of 14.8 and 38.2 are compared in this paper. The measured data were obtained using an NE-213 liquid scintillator and the calculated data were obtained using the Monte Carlo code MCNP and the discrete ordinates code DOT 4.3. For both duct geometries, the spectra calculated using the MCNP code are in reasonable agreement with the measured data ranging from a few percent to a factor of two, depending on the detector location and duct. The spectra calculated using the DOT code are in fair agreement (30%) for cases where the detector is on the duct axis, but are in poor agreement, up to an order of magnitude, when the detector is off axis. 6 refs., 7 figs., 4 tabs.

12499 **(PPPL—2279) Amplification of S-1 Spheromak current by an inductive current transformer.** Jardin, S.C.; Janos, A.; Yamada, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1985. Contract AC02-76CH03073. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005039.

We attempt to predict the consequences of adding an inductive current transformer (OH Transformer) to the present S-1 Spheromak experiment. Axisymmetric modeling with only classical dissipation shows an increase of toroidal current and a shrinking and hollowing of the current channel, conserving toroidal flux. These unstable profiles will undergo helical reconnection, conserving helicity $K = \int$ A-vector x B-vector d tau while increasing the toroidal flux and decreasing the poloidal flux so that the plasma relaxes toward the Taylor state. This flux rearrangement is modeled by a new current viscosity term in the mean-field Ohm's law which conserves helicity and dissipates energy.

12500 **(PPPL—2288) Eddy currents in a nonperiodic vacuum vessel induced by axisymmetric plasma motion.** DeLucia, J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1985. Contract AC02-76CH03073. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005035.

A method is described for calculating the two-dimensional trajectory of a vertically or horizontally unstable axisymmetric tokamak plasma in the presence of a resistive vacuum vessel. The vessel is not assumed to have toroidal symmetry. The plasma is represented by a current-filament loop that is free to move vertically and to change its major radius. Its position is evolved in time self-consistently with the vacuum vessel eddy currents. The plasma current, internal inductance, and poloidal beta can be specified functions of time so that eddy currents resulting from a disruption can be modeled. The vacuum vessel is represented by a set of current-filaments whose positions and orientations are chosen to model the dominant eddy current paths. Although the specific application is to TFTR, the present model is of general applicability. 7 refs., 4 figs., 2 tabs.

12501 **(SAND—85-1364C) Infrared thermography of first wall components on TMX-U.** Watkins, J.G.; Hsu, W.L.; Dykhuizen, R.C.; Hill, D.N.; Allen, S.L. (Sandia National Labs., Albuquerque, NM (USA); Lawrence Livermore National Lab., CA (USA)). 1985. Contract W-7405-ENG-48;AC04-76DP00789. 13p. (CONF-851174—25). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004607.

From 32. national vacuum symposium and topical conference; Houston, TX, USA (19 Nov 1985).

Infrared thermography in the 8 to 12 micron wavelength range was used to measure surface heating on the Low Energy Neutral Source (LENS) plates in the Tandem Mirror Experiment Upgrade (TMX-U). A surface temperature rise of 3.5°C was observed at the plasma edge during discharges lasting 70 ms with edge densities of approximately 10^{12} cm^{-3}. However, surface heating appeared to be non-uniform azimuthally in that the bottom plates showed a greater temperature rise. A few seconds after the termination of the discharge an axial view of TMX-U revealed an additional form of surface heating. This is consistent with observations from the x-ray diagnostic which showed that a significant concentration of energetic electrons remained after the bulk thermal plasma had disappeared; these electrons disappeared only after the magnets were turned off. Details of the experiment and our experiences with this diagnostic tool will be presented. 6 refs., 4 figs.

12502 **(SAND—85-1886) Current neutralization of intense light ion beams in argon gas.** Swegle, J.A.; Slutz, S.A. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1985. Contract AC04-76DP00789. 93p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86004853.

This paper describes a theoretical treatment for the current neutralization of intense ion beams propagating radially inward through the drift region of a cylindrical Applied-B diode. The drift region is bounded by conducting walls, and the beams are taken to have a current density profile that is constant across the surface transverse to the direction of propagation. The current neutralization calculation involves breaking the return current density into spatial harmonics in the transverse coordinate in such a way that the return current density vanishes at the walls. Each spatial harmonic is then shown to approximately obey a magnetic decay equation with a time constant proportional to the electrical conductivity of the gas. This coductivity is time dependent and is calculated locally from the degree of ionization and plasma heating created by the beam and the return current. Beams composed of protons and carbon ions are considered, and time of flight effects on the beam current and energy spectra are taken into account. The effects of drift region parameter variations on the time development of the conductivity and current neutralization are evaluated. Comparisons are made with experimental measurements taken at Sandia National Laboratories on the Proto-I accelerator, and strengths and weaknesses of the present model are discussed. 38 refs., 30 figs., 2 tabs.

12503 **(UCID—20569) Impact of several reactor features on TF coil design for TPSS.** Miller, J.R. (Lawrence Livermore National Lab., CA (USA)). 10 Jan 1986. Contract W-7405-ENG-48. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005292.

Limits of acceptable radiation levels relative to winding pack current densities in the toroidal field (TF) coils is given for relevant reactor designs. Force cooled conductors are stipulated in this study. The maximum field which can be supported while maintaining adequate stability and the ability to protect the coils in the event of a quench to end of the machine life is reported to be 6T. TF configuration, winding pack design, heat removal, stability, copper fraction and effect of damage, limiting current, and protection are discussed. 12 refs., 2 tabs. (WRF)

12504 **(UCID—20619) Injector modeling and achievement/maintenance of high brightness.** Boyd, J.K. (Lawrence Livermore National Lab., CA (USA)). Oct 1985. Contract W-7405-ENG-48. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86004906.

Viewgraphs for the workshop presentation are given. The presentation has three fundamental parts. In part one the need for numerical calculations is justified and the available computer codes are enumerated. The capabilities and features of the DPC computer code are the focal point in this section. In part two the injector design issues are discussed. These issues include such things as the beam optics and magnetic field profile. In part three the experimental results of two injector designs are compared with DPC predictions. 8 figs.

12505 **(UCRL—50021-84) Laser Program annual report 1984.** Rufer, M.L.; Murphy, P.W. (eds.). (Lawrence Livermore National Lab., CA (USA)). Jun 1985. Contract W-7405-ENG-48. 488p. NTIS, PC A21/MF A01; 1; GPO Dep. File Number DE86005297.

The Laser Program Annual Report is part of the continuing series of reports documenting the progress of the unclassified Laser Fusion Program at the Lawrence Livermore National Laboratory (LLNL). As in previous years, the report is organized programmatically. The first section is an overview of the basic goals and direc-

tions of the LLNL Inertial Confinement Fusion (ICF) Program, and highlights the year's important accomplishments. Sections 2 through 7 provide the detailed information on the various program elements: Laser Systems and Operations, Target Design, Target Fabrication, Laser Experiments and Advanced Diagnostics, Advanced Laser Development, and Applications of Inertial Confinement Fusion. Individual sections will be indexed separately. 589 refs., 333 figs., 25 tabs.

12506 **(UCRL—53633) FORIG: a computer code for calculating radionuclide generation and depletion in fusion and fission reactors. User's manual.** Blink, J.A. (Lawrence Livermore National Lab., CA (USA)). Mar 1985. Contract W-7405-ENG-48. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86005296.

In this manual we describe the use of the FORIG computer code to solve isotope-generation and depletion problems in fusion and fission reactors. FORIG runs on a Cray-1 computer and accepts more extensive activation cross sections than ORIGEN2 from which it was adapted. This report is an updated and a combined version of the previous ORIGEN2 and FORIG manuals. 7 refs., 15 figs., 13 tabs.

12507 **(UCRL—92557) Neutron activation in Cascade: the BeO/$LiAlO_2$ case.** Meier, W.R. (Lawrence Livermore National Lab., CA (USA)). 6 Nov 1985. Contract W-7405-ENG-48. 7p. (CONF-851102—50). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004236.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

Neutron activation calculations have been carried out for the Cascade inertial confinement fusion reactor concept. The Cascade chamber features a flowing granular blanket which consists of a carbon surface layer, a BeO multiplier, and a $LiAlO_2$ breeder. The blanket, with an effective thickness of 0.5 m, shields the chamber structural wall, which is made out of silicon carbide. A borated water shield surrounds the chamber. The results of the neutron activation calculations for Cascade indicate that the activity is significantly less than in recent magnetic fusion reactor designs. The activity at shutdown is dominated by ^{24}Na, which is produced by (n,α) reactions with Al. The shutdown decay heat, which is also dominated by ^{24}Na, can be dissipated by thermal radiation so that active shutdown cooling is not required to prevent melting of the blanket materials or chamber structures. In order to qualify for shallow land burial, both the BeO and $LiAlO_2$ will require significant dilution; the BeO is limited by ^{14}C, while $LiAlO_2$ is limited by ^{39}Ar and ^{26}Al.

12508 **(UWFDM—633) Review of failure criteria for thin wall structures in a high heat flux environment.** Glasgow, B.B. (Wisconsin Univ., Madison (USA). Fusion Technology Inst.). Mar 1985. Contract AC02-82ER52082. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004845.

The first wall components of fusion reactors will be subjected to a severe environment including 14 MeV neutrons, energetic particles, pulsed heat fluxes, and corrosive coolants. Because of the high heat fluxes, the first wall components will probably have to be thin-walled structures. It is believed that the growth of flaws or cracks to a critical size will be the dominant failure mechanism for first wall components. It is proposed to develop a structural analysis code for first wall components to evaluate structural and materials performance. Two existing codes, WISECRACK and TSTRESS, developed at the University of Wisconsin-Madison, will be modified to accomplish this task. 49 refs., 34 figs.

12509 **Electron heating caused by parametrically driven turbulence near the critical density.** Mizuno, K.; DeGroot, J.S.; Estabrook, K.G. (Department of Applied Science, University of California, Davis, California 95616). *Physics of Fluids;* **29**: No. 2, 568-577(Feb 1986).

Microwave-driven experiments and particle simulation calculations are presented that model s-polarized laser light incident on a pellet. In the microwave experiments, the incident microwaves are observed to decay into ion and electron waves near the critical density if the microwave power is above a well-defined threshold. Significant absorption, thermal electron heating, and hot electron generation are observed for microwave powers above a few times threshold. Strong absorption, strong profile modification, strongly heated hot electrons with a Maxwellian distribution, a hot-electron temperature that increases slowly with power, and a hot-electron density that is almost constant, are all observed in both the microwave experiments and simulation calculations for high powers. In addition, the thermal electrons are strongly heated for high powers in the microwave experiments.

12510 **Lithium purification technique.** Keough, R.F.; Meadows, G.E. (to Dept. of Energy). US Patent 4,528,032. 9 Jul 1985. Filed date 10 Jan 1984. vp.

PAT-APPL-569698.

A method for purifying liquid lithium to remove unwanted quantities of nitrogen or aluminum. The method involves precipitation of aluminum nitride by adding a reagent to the liquid lithium. The reagent will be either nitrogen or aluminum in a quantity adequate to react with the unwanted quantity of the impurity to form insoluble aluminum nitride. The aluminum nitride can be mechanically separated from the molten liquid lithium.

12511 **Neutral beam heating system for the tokamak fusion test reactor.** Grisham, L.R.; Eubank, H.P.; Kamperschroer, J.H.; Kugel, H.W.; Martin, G.D.; Prechter, R.E.; Prichard, B.A. Jr.; Williams, M.D.; Winje, R.A.; Wright, K.E. (Princeton Univ., NJ, USA. Plasma Physics Lab.). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **10/11**: 478-482(15 May 1985). (CONF-841117—).

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

A neutral beam injection system will be the principal heat source for the plasma of the Tokamak Fusion Test Reactor. This system will use twelve positive ion sources (developed by Lawrence Berkeley Laboratory) on four beamlines (designed by Lawrence Livermore Laboratory) to deliver up to 27 MW of neutral power to the plasma as D^0 at a maximum energy of 120 keV. The first two beamlines are becoming operational in 1984.

99 GENERAL AND MISCELLANEOUS

12512 **(DOE/MA—0142/2) Department of Energy Annual Procurement and Federal Assistance report, FY 1985.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Procurement and Assistance Management Directorate). Dec 1985. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86005104.

DOE procurement and Federal assistance obligations in FY 1985 were $14,727,934,119, a decrease of 0.6% from FY 1984. Obligations for management and operating contractors totalled $10,230,559,654, a 5.7% increase over FY 1984. The number of active procurement awards over $25,000 (excluding management and operating contracts) on September 30, 1985, was 3,470 with a total award value of $41,837,050,416. This compares with 3,649 active awards with a value of $37,280,349,171 on September 30, 1984. The number and award value of Federal assistance instruments active on September 30, 1985, was 5,303 and $3,420,232,433. On September 30, 1984, there were 5,414 active awards with a value of $2,919,968,302. Subcontract awards were worth $4,655,672,789 in FY 1985, of which $2,822,266,303 (61%) went to small business firms. In FY 1984, subcontracts worth $4,362,191,000 were awarded, of which $2,082,417,000 (47.7%) were awarded to small businesses. The Department funded 416 unsolicited proposals with a total value of $142 million in FY 1985. During the previous fiscal year, 571 unsolicited proposals were funded with a total award value of $135 million.

12513 **(DOE/OR/20917—T1) Nuclear Studies Training Program. Final report.** (Memphis State Univ., TN (USA). Center for Nuclear Studies). 1984. Contract AS05-81OR20917. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86004529.

The Nuclear Skill Training Program at Memphis State University sponsored by the Department of Labor, Office of Job Corps was initiated with the intent to train individuals for entry-level posi-

tions in the nuclear electric power industry leading to the job classifications of "nuclear reactor operator," "health physicist," or "instrument and control technician." Objectives of this program were: to recruit, test, select, and train sixty individuals from Region IV Job Corps Centers for unsubsidized employment in the nuclear power industry while providing an academically supportive environment and academic credit for the coursework undertaken.

12514 **(ORNL/PPA—85/2) Oak Ridge National Laboratory Institutional Plan, FY 1986-FY 1991.** Watkins, R.M. (ed.). (Oak Ridge National Lab., TN (USA)). Oct 1985. Contract AC05-84OR21400. 114p. NTIS, PC A06/MF A01; GPO Dep. File Number DE86004590.

The composition of the Laboratory will change during the next 15 years as the program emphasis shifts to major missions in energy and related defense technologies. Broadly stated, the goals in these areas are: to preserve and advance nuclear power, to develop a net-power-producing magnetic fusion reactor, to focus conservation and fossil energy research in areas of special competence, to support the Strategic Defense Initiative in areas of special competence, to create a strong technical base for basic energy sciences, to create a basic understanding of the environmental and health effects of energy technologies, to create and support national facilities in basic physics, and to become the center for hazardous waste science and technology.

9901 Management

REFER ALSO TO CITATION(S) 12386

12515 **(DOE/IG—0223) Audit of joint owner costing and billing practices, Naval Petroleum Reserve No. 1, Elk Hills, California.** Richards, J.R. (USDOE Office of Inspector General, Albuquerque, NM. Office of Audits). 13 Jan 1986. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005152.

Report to The Secretary.

The review showed a need for the Department to revise and strengthen cash management and cost allocation procedures and practices for jointly shared Reserve operating costs funded by the Government. The procedures and practices in effect for processing Joint Owner costs, billings and collections do not permit the Government to receive full advantage of the time value of money paid in behalf of Chevron or provide for the full sharing of all costs incurred by the Government to absorb unnecessary interest and operating costs since assuming responsibility for funding Reserve operations in October 1975. It is estimated that the Department would benefit by over $3 million per year if our recommendations in these areas are fully implemented.

12516 **(INIS-mf—10037) AAEC report titles - cumulation 1976-1984.** (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Aug 1985. 53p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86701206.

All unclassified technical reports issued by the AAEC Research Establishment from 1976 to 1984 are listed.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 12127

12517 **(ANL—85-70) Quasi-automatic parallelization: a simplified approach to multiprocessing.** Glickfeld, B.W.; Overbeek, R.A. (Argonne National Lab., IL (USA)). Oct 1985. Contract W-31-109-ENG-38. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86005120.

As multiprocessors become commercially available, a great deal of concern is being focused on the problems involved in writing and debugging software for such machines. Earlier work described the use of monitors implemented by macro processors to attain portable code. This work formulates a general-purpose monitor which simplifies the programming of a wide class of numeric algorithms. We believe that the approach of describing a set of schedulable units of computation advocated by Brown offers a real simplification for the applications programmer. In this paper, we propose a straightforward programming paradigm for describing schedulable units of computation that allows the description of many algorithms with very little effort. 5 refs.

12518 **(ANL/MCS-TM—60) Quasi-Newton methods with bounds.** Calamai, P.H.; More, J.J. (Argonne National Lab., IL (USA)). Oct 1985. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004966.

We develop a quasi-Newton method which preserves known bounds on the Jacobian matrix. We show that this update can be computed with the same amount of work as competitive methods. In particular, we prove that the number of operations required to obtain this update is proportional to the number of nonzeros in the sparsity pattern of the Jacobian matrix. The method is also shown to share the local convergence properties of Broyden's and Schubert's method. 16 refs.

12519 **(BNL—37221) FASTRUN: a high performance computing device for molecular mechanics using a pipeline architecture.** Dimmler, D.G.; Fine, R.; Levinthal, C. (Brookhaven National Lab., Upton, NY (USA); Columbia Univ., New York (USA)). Oct 1985. Contract AC02-76CH00016. 7p. (CONF-851009—41). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004355.

From IEEE nuclear science symposium; San Francisco, CA, USA (23 Oct 1985).

A deep, synchronous pipeline architecture has been selected for a computing device with a power of 500 million floating point operations per second (Mflops). The device calculates the forces and energy due to pair-wise interactions of many objects in a system. Considerations relating to application specific high-performance computer architectures are addressed. In addition, topics specifically relating to very deep, synchronous unidirectional pipelines are discussed. A key element of the device, a quadratic interpolator based on a lookup table, has been developed and tested. Five of these interpolators with a total computing power of 280 Mflops will be employed in the device.

12520 (INIS-mf—9626-Vol.2, pp 152-158) **Monte Carlo calculations in environmental monitoring - applicability and limitations.** Hofmann, W. (Salzburg Univ. (Austria). Inst. fuer Allgemeine Biologie, Biochemie und Biophysik); Tschurlovits, M. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1984. NTIS (US Sales Only), PC A13/MF A01. File Number DE85781217. (CONF-830995—Vol.2).

From 11. regional congress of the International Radiation Protection Association: recent developments and trends in radiation protection; Vienna, Austria (20 Sep 1983).

Monte Carlo calculations are becoming increasingly applied in environmental investigations. When multi compartments are used, the transfer parameters may vary substantially and the use of a mean value is not sufficient. Therefore, distributions of parameters have to be introduced into the calculations. If these distributions have to be proved by actual measurements, the question how many data are necessary for a reasonable assessment arise. This paper concerns itself with the establishment of a parameter indication the goodness of data.

12521 **(LA-UR—85-4331) Scaling in fat fractals.** Farmer, J.D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-8509203—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004740.

From International conference on dimensions and entropies in chaotic systems; Pecos River, NM, USA (11 Sep 1985).

Fat fractals are fractals with positive measure and integer fractal dimension. Their dimension is indistinguishable from that of nonfractals, and is inadequate to describe their fractal properties. An alternative approach can be couched in terms of the scaling of the coarse grained measure. For the more familiar "thin" fractals, the resulting scaling exponent reduces to the fractal codimension, but for fat fractals it is independent of the fractal dimension. Numerical experiments on several examples, including the chaotic pa-

rameter values of quadratic mappings, the ergodic parameter values of circle maps, and the chaotic orbits of area preserving maps, show a power law scaling, suggesting that this is a generic form. This paper reviews several possible methods for defining coarse grained measure and associated fat fractal scaling exponents, reviews previous work on the subject, and discusses problems that deserve further study.

12522 **(LA-UR—85-4404) CFT compiler optimization and Cray X-MP vector performance.** Bucher, I.Y.; Simmons, M.L. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 9p. (CONF-8509219—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86004746.

From Cray users group meeting; Montreal, Canada (30 Sep 1985).

The motivation for this paper was the observation that Cray X-MP vector performance has not always evolved in the expected direction of improvement. It is well known that vector performance of register-to-register vector computers is strongly compiler dependent. The compiler is responsible for properly sequencing vector load, arighmetic, and store operations, and for scheduling necessary scalar operations in such a way that they take place while vector operations are in progress and therefore do not consume any additional time. We have analyzed vector performance data for CFT compiler versions 1.10 through 1.14. It is concluded that in spite of the great performance improvements achieved by version 1.14 of CFR, further speedups are possible by eliminating the slowdowns introduced in version 1.11.

12523 **(SAND—85-1595) RDEAM: an Adams ODE code with root solving capability.** Watts, H.A. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1985. Contract AC04-76DP00789. 64p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86004971.

Our goal has been to develop a robust root solving ODE code; that is, one which solves differential equations and isolates roots of specified event functions in the solution variables. This work concentrated on computational and software issues aimed at enhancing the reliability of locating the roots in question. Thus the primary emphasis has been placed on providing a capability which has not previously been available, and one which is needed for handling difficult and sensitive root problems. There is no doubt that we are doing a lot of work in attempting to guarantee the finding of all roots, regardless of the problem formulation. This effort is what we have referred to as the refined or sophisticated root searching procedure. It is relatively expensive, but necessary, for some problems. A less expensive and more conventional mode of operation for the root solving is also available to the user. This approach skips the refined root searching so that root detection is based solely on looking for a sign change at the endpoints of the integration step size interval. This will work well provided there is a good correlation between the step sizes taken for the integration problem and the scale or variation of the event functions. Otherwise roots are likely to be missed. 20 refs.

12524 **(UCRL—53648) Multiprocessor model with distributed task creation.** Wirsching, J.E. (Lawrence Livermore National Lab., CA (USA)). Jun 1985. Contract W-7405-ENG-48. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005302.

A model has been constructed that simulates the operation of a multiprocessor by means of a computer program, MULTIMOD, which simulates the execution of a FORTRAN program. During the execution of MULTIMOD, all application program operands are moved from memory locations through connection networks and ancillary registers and queues to their destinations. (The model simulates hardware, including processors, memory modules, connection networks, and connective registers and queues.) The arithmetic of the application and all indexing are performed, and all loop operations are carried out. MULTIMOD times all work done, and mutual interference of all elements is accounted for. The present model requires the FORTRAN source program to be augmented, and the augmented FORTRAN program supports a completely decentralized task-creation method. The hardware modeled uses fully implemented Banyan networks or full crossbars for data and synchronization and a ring network for task handling. Two kinds of sentinels are used in handling operands: one kind is used to control data requests, and the second is used to describe the data state. In addition, MULTIMOD implements such concepts as OUT-OF-BOUNDS, READ-ONLY, LOCK, EMPTY/FULL, and TAG-MATCH. Whenever possible, the model uses data-flow-methods.

12525 **(LA-tr—84-22-Rev.) FACOM VP supercomputer of parallel pipeline processing system has achieved 7.5 ns machine cycle.** Hiraguri, T.; Tabata, A.; Tsuchimoto, T.; Taguchi, S. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. Translated from Nikkei erekutronikusu; 4: No. 11, 131-155(1983). 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86003879.

At the end of 1983 Fujitsu will begin to deliver its FACOM VP supercomputer, which has a machine cycle of 7.5 ns and a maximum performance of 53 MFLOPS. Its main storage can be expanded to 256 megabytes, and 64 kiloBIT static RAMs with an access time of 55 ns are used as its elements. A parallel pipeline processing has been adopted as the means of attaining high speeds. The vector registers have a maximum capacity of 64 kilobytes, and the transfer rate between them and the main storage is 4 gigabytes per second. An effective computing speed of 7.5 ns (of one pipeline operator) has been achieved thanks to the adoption of ingenious design features in the circuit configuration and to the inheriting of the M-380 technology. The target in development is to obtain a high vectorizing ratio throughout a broad range of scientific and engineering computations. In order to attain this, even the macro operations and conditional statements are subject to vectorizing. In addition, an interactive vectorizer has been provided as a tool in order to make it possible to improve the vectorizing ratio by means of tuning.

12526 **Parallel-processing a large scientific problem.** Hiromoto, R. Arlington, VA; Afips Press (1982). 4p.

The author discusses a parallel-processing experiment that uses a particle-in-cell (PIC) code to study the feasibility of doing large-scale scientific calculations on multiple-processor architectures. A multithread version of this Los Alamos PIC code was successfully implemented and timed on a Univac system 1100/80 computer. Use of a single copy of the instruction stream, and common memory to hold data, eliminated data transmission between processors. The multiple-processing algorithm exploits the Pic code's high degree of large, independent tasks, as well as the configuration of the Univac system 1100/80. Timing results for the multithread version of the PIC code using one, two, three, and four identical processors are given and are shown to have promising speedup times when compared to the overall run times measured for a single-thread version of the PIC code. 4 references.

9903 Information Handling

12527 **Coping with the information explosion provided by modern chemical instrumentation.** Perone, S.P. (Lawrence Livermore National Lab., CA). *ACS Symposium Series;* No. 265, 99-107(1984). Contract W-7405-ENG-48.

Modern chemical instrumentation is capable of generating enormous amounts of data in very short periods of time. It is clear that a major task of scientists for the near future is to develop techniques to utilize more effectively this capability, in order to avoid the typical dilemma of being buried in data with little or no perspective of the information content. Thus, there are three key developments that must be pursued: definition of information content; identification of methods to correlate instrumental parameters with information content; and development of tools for the instrumental enhancement of information content and the efficient extraction of information from data. These developments should allow the evolution of smart instruments, perhaps guided by artificial intelligence principles. This paper will describe some of the principles and tools that have already been developed, and will identify the areas where work needs to be done.

CORPORATE AUTHOR INDEX

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A

Advanced Information and Decision Systems, Mountain View, CA (USA)
Information structures for the control of large scale systems. Final technical report, September 1980-March 1984, 11:11210 (R;US)

Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.
Effects of whistler-mode and other waves in the magnetosphere. Final report 1981-1984, 11:12053 (R;US)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)
Analysis of the effects of transient heat transfer on axial-flow-compressor-blade boundary layers. Master's thesis, 11:11762 (R;US)
Sorption and desorption of volatile chlorinated aliphatic compounds by soils and soil components. Doctoral theses, 11:11914 (R;US)

Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung
Third working meeting on radiation interaction. 1, 11:11713 (R;DD)
Third working meeting on radiation interaction. 2, 11:11714 (R;DD)

Alabama Univ., Huntsville (USA)
Direct coal liquefaction using iron-titanium hydride as a hydrogen distribution and catalytic material. Progress report No. 5, September 1-November 30, 1985, 11:10786 (R;US)

Allied Corp., Charlotte, NC (USA). Synthetic Crystal Products Group
Research in gadolinium scandium gallium garnet (GSGG) crystal development. Final report, 1 May-31 December 1984, 11:11757 (R;US)

Allied Corp., Morristown, NJ (USA)
Development of a residential gas fired absorption heat pump. Physical and thermodynamic properties of R123A/ETFE system development and testing economic analysis. Final report, 11:11447 (R;US)

Ames Lab., IA (USA)
Magnetic moments of excited states in nuclei far from stability, 11:12327 (R;US)

Analysis and Technology, Inc., North Stonington, CT (USA)
Instructional skills evaluation in nuclear industry training, 11:11391 (R;US)

Ankara Nuclear Research and Training Center (Turkey)
Progress report 1984, 11:12268 (R;TR;In Turkish)

AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki
Hopf equation for an infinite-dimensional phase space dynamical system and Euclidean quantum field theory, 11:12245 (R;SU;In Russian)

AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij
Unification of the Krylov-Fock theorem and solution of Davydov paradox of the decaying systems, 11:12371 (R;UA;In Russian)

Argonne National Lab., IL (USA)
BWR pipe crack and weld clad overlay studies, 11:11231 (R;US)
Coal conversion (liquefaction/gasification): engineering considerations and relationships among physical, chemical and toxicological properties of resulting materials, 11:10793 (R;US)
Corrosion of ceramic refractories exposed to a synthetic coal slag by means of the rotating-drum technique, 11:11552 (R;US)
EBR-II Shutdown Heat Removal Testing Program results and plans, 11:11299 (R;US)
Effect of sulfur sorbent and gas cycling on corrosion of FBC materials at 866 K, 11:10896 (R;US)
Electrode kinetic measurements of very fast reactions: metal deposition-dissolution in molten halides, 11:11366 (R;US)
Emergence of interest groups on hazardous waste siting: how do they form and survive, 11:11389 (R;US)
First international workshop on battery testing, 30 September-2 October 1985, Heidelberg, FRG. Summary report, 11:11364 (R;US)
First international workshop on battery testing. Workbook and extended abstracts. Summaries, 11:11368 (R;US)
Fourier-filtering techniques for the analysis of high-resolution pulsed neutron powder diffraction data, 11:11557 (R;US)
Fuel cell power plant designs: a review, 11:11408 (R;US)
Magnetic depth profiles by neutron reflection, 11:11508 (R;US)
Posttest analysis of beta (Na/S) cells from chloride silent power, limited. Final report, 11:11370 (R;US)
Quasi-automatic parallelization: a simplified approach to multiprocessing, 11:12517 (R;US)
Quasi-Newton methods with bounds, 11:12518 (R;US)
Radioactive waste isolation in salt: peer review of Westinghouse Electric Corporation's report on reference conceptual designs for a repository waste package, 11:10997 (R;US)
Role of electric vehicles in the nation's energy future, 11:11493 (R;US)
Structure functions of nuclei in the pion exchange model, 11:12356 (R;US)
Testing activities at the National Battery Test Laboratory, 11:11363 (R;US)
Testing and development of electric vehicle batteries for EPRI Electric Transportation Program. Technical report for November 1982-December 1984, 11:11362 (R;US)
Thermal conductivities of U_3Si and U_3Si_2-Al dispersion fuels, 11:11280 (R;US)
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Use of computer simulation technique to study atomic migration in solids, 11:11577 (R;US)

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Membrane barriers for radon gas flow restrictions, 11:10976 (R;CA)
Recommendations concerning an interim annual individual exposure limit for respirable quartz, 11:11077 (R;CA)
Techniques of sample attack used in soil and mineral analysis. Phase I, 11:11614 (R;CA)
Toxicity levels to humans during acute exposure to hydrogen fluoride, 11:12008 (R;CA)
Welding of carbon steel vessels without post weld heat treatment, 11:11521 (R;CA)
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Ground state mass excesses and low lying levels of the neutron rich nuclei ^{36}P, ^{35}P and ^{34}P, 11:12311 (R;AU)
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Masses and level schemes of ^{33}Si and ^{34}Si, 11:12310 (R;AU)
Octupole vibrational states in the even-mass barium isotopes, 11:12326 (R;AU)
Yrast spectroscopy of ^{209}Rn, 11:12340 (R;AU)
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Network approach to large-scale experimental data acquisition and analysis, 11:12473 (R;AU)
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Residual radioactive contamination at Maralinga and Emu, 1985, 11:11898 (R;AU)

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Condensing heat exchanger systems for residential/commercial furnaces and boilers. Phase IV, 11:11413 (R;US)
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Recent achievements in meson sciences at TRIUMF, 11:12164 (R;CA)
Brookhaven National Lab., Upton, NY (USA)
6.4 Tesla dipole magnet for the SSC, 11:11805 (R;US)
Analysis of hydrogen production during a BWR6 core heatup transient, 11:11296 (R;US)
Beams for kaon research, 11:11793 (R;US)
Cation shifts in human retina-choroid, 11:11965 (R;US)
Comparative analysis of constitutive relations in TRAC-PF1 and RELAP5/MOD1, 11:11234 (R;US)
Comparison of methods applicable to evaluation of nuclear power plant technical specifications, 11:11294 (R;US)
Containment performance evaluation for the GESSAR-II plant for seismic initiating events, 11:11293 (R;US)
Description of the intense, low energy, monoenergetic positron beam at Brookhaven, 11:11114 (R;US)
Detection and quantitation of left-to-right shunting by iridium-191m angiography, 11:11717 (R;US)
Evaluation of ATWS core damage frequency for an earlier vintage BWR/4, 11:11292 (R;US)
FASTRUN: a high performance computing device for molecular mechanics using a pipeline architecture, 11:12519 (R;US)
Guidebook for the assembly and use of diverse ground water data, 11:12028 (R;US)
Hypernuclear gamma rays, 11:12036 (R;US)
Impact of mechanical- and maintenance-induced failures of main reactor coolant pump seals on plant safety, 11:11336 (R;US)
Liquid jet breakup characterization with application to melt-water mixing, 11:11295 (R;US)
Magnetic moments of excited states in nuclei far from stability, 11:12327 (R;US)
Management perceptions of the Health Physics Technician job, 11:11334 (R;US)
Mechanistic determination of fission product releases for a Mark III BWR plant, 11:11297 (R;US)
Modeling residential natural gas demand at the state level, 11:10959 (R;US)
Partial wave analysis of KKPI system in D and E/IOTA region, 11:12140 (R;US)
Particle dynamics for motion in a non-planar accelerator, 11:11789 (R;US)
Performance results from the Hydrogen Technology Evaluation Center at Brookhaven National Laboratory, 11:11119 (R;US)
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RAMONA-3B application to Browns Ferry ATWS, 11:11298 (R;US)
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SIMBID: An alternative, simplified model of bidding and awarding of new natural gas reserves, 11:10960 (R;US)
Single-crystal neutron diffraction study of the distribution and thermal motion of silver ions in alpha- and beta-Ag_3SI, 11:11573 (R;US)
Status of the National Synchrotron Light Source upgrade, 11:11783 (R;US)
Structural load combinations, 11:11225 (R;US)
Thermal distribution and utilization: an interim progress report, 11:11412 (R;US)
Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)
Brooklyn Coll., NY (USA)
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High resolution studies of photofission of ^{232}Th and ^{238}U, 11:12349 (R;US)
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Numerical modeling of a solid particle solar central receiver, 11:11178 (R;US)
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Ideas on the pomeron-proton interaction at the parton level, 11:12182 (R;CH)
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California Univ., Santa Barbara (USA). Inst. for Theoretical Physics
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Empirical methods of support design for the Sydney coalfield, 11:10820 (R;CA)
Research oriented technological needs in the Sydney coalfield, 11:10818 (R;CA)
Strata control investigations in the Sydney coalfield - Annual report, January 1 to December 31, 1984, 11:10819 (R;CA)
Strength and deformation properties of various rocks from the Springhill coal mine, Nova Scotia, 11:10821 (R;CA)
Study of rock behaviour for the Donkin-Morien rock/support interaction contract, 11:10822 (R;CA)
System for gathering dragline data using an electronic data logger and modem, 11:10817 (R;CA)

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Preliminary separation of the lanthanide group using DHDECMP, 11:11604 (R;FR)
Process for the recovery of americium from analytical wastes, 11:11605 (R;FR)

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Soft X-ray imaging with axisymmetry microscope and electronic readout, 11:12426 (R;FR)
Vectorization and multitasking with a Monte-Carlo code for neutron transport problems, 11:12382 (R;FR)
Works on laser-matter interaction program at the Limeil-Valenton center, 11:12427 (R;FR;In French)

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Actinide-lanthanide group separation using sulfur and nitrogen donor extractants, 11:11606 (R;FR)
Behaviour of palladium in the Purex process, 11:10983 (R;FR)
French experience and prospects in the reprocessing of fast breeder reactor fuels, 11:10985 (R;FR;In French)
Preparation of isotopes and sources of actinide elements, 11:11115 (R;FR)
Spent fuel reprocessing past experience and future prospects, 11:10986 (R;FR;In French)
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinides elements, 11:11607 (R;FR)

CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)
Calorimetric investigation of the Y-Er magnetic phase diagram, 11:11505 (R;FR)
Direct spectroscopic observation of molecular hydrogen by high resolution proton NMR and a reinterpretation of the proton NMR spectra for amorphous Si:H, 11:11575 (R;FR)
Irradiation of lithium aluminate and tritium extraction, 11:12474 (R;FR)
Progress report 1983. Physics. Vol. 1, 11:12273 (R;FR;In French)
Study of the thermal annealing of γ-irradiation effects in Al_2O_3: Mn, 11:11554 (R;FR)
Thermal conductivity of neutron irradiated quartz, 11:11574 (R;FR)

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π^+ and π^- production in the α-nucleus and nucleus-nucleus collisions between 200 and 800 MeV/nucleon, 11:12342 (R;FR;In French)
Antiproton-nucleon physics at LEAR, 11:12284 (R;FR;In French)
"CAMERA" test facility in the OSIRIS reactor. Diametral measurement device under flux of PWR fuel pins, 11:11275 (R;FR;In French)
Chemical properties of neptunium applied to neptunium management in extraction cycles of Purex process, 11:10984 (R;FR)
Do collective effects exist in the intra-nuclear cascade, 11:12316 (R;FR;In French)
Experimentation and modelling of U, Th, and lanthanides transport in fissured rocks. Influence of complexation, 11:11057 (R;FR)
Future prospects in photon and electron physics at Saclay, 11:12357 (R;FR)
Irradiation of lithium aluminate and tritium extraction, 11:12474 (R;FR)
Linear momentum transfer in the $^{40}Ar + {}^{238}U$ system for projectile energies from 20 to 44 MeV/u, 11:12348 (R;FR)
Measurement of cross sections of total nuclear photon absorption by the ^{12}C and ^{208}Pb nuclei in the Δ(1232) region, 11:12294 (R;FR;In French)
"OPERA" loop in the OSIRIS reactor core. Pressurized water irradiation device for the study of advanced reactor fuels, 11:11286 (R;FR;In French)
Processing of gamma-ray spectrometric logs, 11:11849 (R;FR;In French)
Quadrupole boson densities in the germanium region by inelastic electron scattering, 11:12328 (R;FR)
Recent picosecond spectroscopy studies of photoactivated electron transfer reactions in solution, 11:11157 (R;FR)
Status and future of the experiment PS 170 (anti $pp \rightarrow e^+ e^-$), 11:12142 (R;FR)
Study of the $^3He(\gamma p)np$ reaction in the region of the resonance Δ(1232), 11:12285 (R;FR;In French)
Subnucleon freedom degrees, 11:12358 (R;FR;In French)
X-neutron comparative study of direct ionic micelles, 11:12381 (R;FR)

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Case of Three Mile Island, 11:11242 (R;BE;In French)

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Deficiency indices and singular boundary conditions in quantum mechanics, 11:12401 (R;FR)
Estimates of quantum deviations from classical mechanics using large deviation results, 11:12400 (R;FR)
Stability and instability in quantum mechanics, 11:12399 (R;FR)
Trapping in stochastic mechanics and applications to covers of clouds and radiation belts, 11:12055 (R;FR)
Universe symmetries, 11:12039 (R;FR;In French)

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Closed homogeneous cosmological model with short range magnetic field, 11:12038 (R;BR;In Portuguese)
Does QCD have infrared renormalons, 11:12222 (R;BR)
Gauge theory for composite fields, 11:12220 (R;BR)
Glueballs in $\pi^- p \rightarrow$ phi phi n, 11:12178 (R;BR)
High temperature interparticle potential for an alternative gauge model, 11:12219 (R;BR)
Lambda$^+$ sub(c) lifetime in a quark-diquark scheme, 11:12181 (R;BR)
New gauge for supersymmetric abelian gauge theories, 11:12218 (R;BR)
Ondulators and Wigglers - Theoretical aspects, 11:11794 (R;BR;In Portuguese)
Possible interaction between spin-1/2 and spin-3/2 fields, 11:12179 (R;BR)
Potts ferromagnet correlation length in hypercubic lattices: Renormalization - group approach, 11:12395 (R;BR)
Pulsar precession: a nod is not as good as a wink, 11:12037 (R;BR)

Some considerations about bond indices in non-orthogonal bases and the MO calculation of valence and oxidation number, 11:11641 (R;BR)
Two gauge fields in the same group, 11:12221 (R;BR)
Vector meson and axial-vector diquark decay constants, 11:12180 (R;BR)

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Effect of bending potential on calculated product-state distributions for the reaction H + D_2 yields HD + D, 11:12059 (R;US)
Nuclear-motion corrections to Born-Oppenheimer barrier heights for chemical reactions, 11:11640 (R;US)
Variational-transition-state theory with least-action tunneling calculations for the kinetic isotope effects in the Cl+h_2 reaction: tests of extended-leps, information-theoretic, and diatomics-in-molecules potential energy surfaces, 11:12062 (R;US)

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Technical and economical feasibility studies and preliminary plan of a heavy water plant by the cryogenic distillation method of hydrogen, 11:11111 (R;CL;In Spanish)

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Exploratory research on mutagenic activity of coal-related materials using statistical evaluation, 11:10921 (R;US)

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Description of the intense, low energy, monoenergetic positron beam at Brookhaven, 11:11114 (R;US)

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General circulation variability, medium to long-range forecasting, and energy industry related applications. Final report, 1 January 1983-31 December 1985, 11:11861 (R;US)
Global low order spectral model designed for climate sensitivity studies, 11:11862 (R;US)
Low-frequency variability in a climate model with a mixed-layer ocean, 11:11860 (R;US)
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Structural load combinations, 11:11225 (R;US)

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Interaction potential for three-particle hadronic systems in the large distance limit, 11:12196 (R;SU)
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Production and decay of quark-gluon strings: inclusive distributions of hadrons in psub(tr) and x, 11:12202 (R;SU)
QCD Hamiltonian in the polar representation, 11:12244 (R;SU)
Quantum decay rate of metastable phase in (1 + 1) dimensions, 11:12408 (R;SU)
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Decomposition of the SO(6) symmetric representations into SU(2)xSU(2)xU(1), 11:12217 (R;FR)
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Indication of neutrino oscillation from the Bugey experiment, 11:12160 (R;FR)
Memory function approach to retardation effects in the relativistic two-body problem, 11:12242 (R;FR)
Recent results from the Bugey neutrino oscillation experiment, 11:12159 (R;FR)
Semiclassical description of currents in normal and superfluid rotating nuclei, 11:12368 (R;FR)
Study and realization of a parallel plate avalanche counter used for time of flight and localization measurements, 11:11834 (R;FR;In French)
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Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
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Hydrogen bonding patterns and dynamics in biological macromolecules, 11:11946 (R;US)
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Anomalous electroweak baryon number non-conservation in the early universe, 11:12183 (R;IT)
Anomaly freedom in chiral supergravities, 11:12230 (R;IT)
Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem, 11:11518 (R;IT)
Collision kernels in the eikonal approximation for Lennard-Jones interaction potential, 11:12084 (R;IT)
Coupling of Yang-Mills to N=4, d=4 supergravity, 11:12229 (R;IT)
Effect of microscopic structure of metal electrode on capacitance of metal - molten salt interface, 11:11519 (R;IT)
Ion model and dipole polarizabilities in energy calculations, 11:11580 (R;IT)
Multiplet classification of the indecomposable highest weight modules over affine Lie algebras and invariant differential operators: the asub(l)sup((1)) example, 11:12227 (R;IT)
Multiplets of indecomposable highest weight modules over infinite-dimensional Lie algebras: The Virasoro - A_1 correspondence, 11:12228 (R;IT)
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Squeezing and antibunching in a one electron FEL model, 11:12402 (R;IT)
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To test photon statistics by atomic beam deflection, 11:12083 (R;IT)
Transition probabilities in superfluid He4, 11:12129 (R;IT)
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Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 11:11635 (D;US)
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Correlations of emission frequency of $\pi 0$ mesons and proton produced in collisions of protons and π^0 mesons with xenon nuclei within the 2-9 GeV energy range and a problem of slow π^0 meson absorption in a target nucleus, 11:12161 (R;SU;In Russian)
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy
Effective cross section matrix and the isotopic relations between the structure functions of inclusive processes, 11:12204 (R;SU;In Russian)
Emission of light fragments ^{3}H, ^{3}He and ^{4}He in ^{4}He-nucleus collisions at 3.33 GeV/N kinetic energy, 11:12369 (R;SU)
Fast-response analog-to-digital processor for event selection by the difference in numbers of particles, 11:11835 (R;SU;In Russian)
Some problems of emergency protection of helium cryostats, 11:11745 (R;SU;In Russian)
Stopping and energy deposition of hadrons in target nuclei, 11:12383 (R;SU)
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics
Correlation between the partial cross sections for the ^{174}Yb(n,2γ)^{175}Yb and ^{176}Yb(d,t)^{175}Yb reactions, 11:12335 (R;SU;In Russian)

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Measurement of the pμ-atom scattering cross section in gaseous hydrogen, 11:12087 (R;SU;In Russian)
Simple method of ^{111}In high temperature isolation from silver, 11:11720 (R;SU;In Russian)
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions
Auger electron spectra in 5.5 MeV/amu Nesup(q+) and Arsup(q+) ion impact on Ne, 11:12086 (R;SU)
Fast neutron emission in interaction of 9 MeV/nucleon ^{12}C and ^{20}Ne ions with ^{181}Ta nuclei, 11:12338 (R;SU;In Russian)
Nonrotational states in ^{160}Er, 11:12336 (R;SU;In Russian)
Observation of a long-lived nuclear quasimolecule in the ^{20}Ne + Ge system, 11:12324 (R;SU;In Russian)
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics
Evolution kernels in QCD: two-loop calculation in the Feynman gauge, 11:12249 (R;SU;In Russian)
Exact calculations of the lowest-order electromagnetic corrections for the processes $e^+e^- \rightarrow \mu^+\mu^-$ (tau^+tau^-), 11:12203 (R;SU)
Fragmentation of subshells in rare earth nuclei, 11:12337 (R;SU;In Russian)
Irreducible *-representations of Lie superalgebras B(O,n) with finite-degenerated vacuum. Results for B(O,1), 11:12248 (R;SU)
Multiquark states in nuclei and the deep inelastic scattering, 11:12370 (R;SU)
One-loop corrections to pion form factor in QCD in a light-like gauge, 11:12246 (R;SU)
Possibility of excitation twist mode selection in the (e, e') reaction, 11:12330 (R;SU;In Russian)
Property of Euclidean Green functions of SU(2) Yang-Mills fields in BPST-instanton background, 11:12247 (R;SU)
Radiative muon capture on ^{16}O, 11:12303 (R;SU;In Russian)
Renormalizations in quantum field theory, 11:12251 (R;SU;In Russian)
Structure radiation in $K \rightarrow 2\pi\gamma$ decays, 11:12205 (R;SU;In Russian)
Topological color confinement, 11:12250 (R;SU;In Russian)

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Magnetic moments of excited states in nuclei far from stability, 11:12327 (R;US)
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Chromosome investigations on persons whose mothers have been treated with ionizing radiations during pregnancy, 11:11995 (R;DE;In German)
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Renormalized turbulence theory of ion pressure gradient driven drift modes, 11:12432 (R;US)

L

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6.4 Tesla dipole magnet for the SSC, 11:11805 (R;US)
Chaos and turbulence in an electron-hole plasma in germanium, 11:11523 (R;US)
Effect of oxygen concentration on the corrosion of molybdenum in flowing water, 11:11788 (R;US)
Flavour tagging of parton jets, 11:12144 (R;US)
New Compton densitometer for measuring pulmonary edema, 11:11979 (R;US)
Optical and electrochemical study of model zinc electrode pores in alkaline electrolyte, 11:11699 (R;US)
Physical and chemical events that follow the passage of a charged particle in liquid water, 11:12389 (R;US)
Reliable predictions of waste performance in a geologic repository, 11:11059 (R;US)
Temperature dependence of the ^{57}Fe hyperfine magnetic field distribution in Fe-Ni, 11:11522 (R;US)
Thermal transport: a comparison between solid and shell targets, 11:12490 (R;US)
Transient and temperature-dependent phenomena in Ge:Be and Ge:Zn far infrared photoconductors, 11:11583 (R;US)
Two-dimensional diffusion limited system for cell growth, 11:11985 (R;US)
X-Ray Data Booklet. Center for X-Ray Optics, 11:12385 (R;US)
Lawrence Livermore National Lab., CA (USA)
Aluminum-Air Power Cell: the M4-cell assembly and initial tests, 11:11373 (R;US)
Beam breakup and the conceptual design of guided and unguided accelerators, 11:11791 (R;US)
Concept of underground nuclear power plant siting for retaining post accident atmospheres, 11:11354 (R;US)
Contour-to-grid methods for the ARAC system, 11:11886 (R;US)
DOE natural phenomena hazards mitigation conference: proceedings, 11:11769 (R;US)
Electrical configuration for magnetic drift pumping on the tandem mirror experiment-upgrade (TMX-U), 11:12455 (R;US)
Energy and Technology Review, 11:11758 (R;US)
FORIG: a computer code for calculating radionuclide generation and depletion in fusion and fission reactors. User's manual, 11:12506 (R;US)
High-resolution absorption spectrum of the $6^1S_0 \rightarrow 6^3P_1$ transition in mercury with a Cw dye laser, 11:12092 (R;US)
Impact of several reactor features on TF coil design for TPSS, 11:12503 (R;US)
Infrared thermography of first wall components on TMX-U, 11:12501 (R;US)
Injector modeling and achievement/maintenance of high brightness, 11:12504 (R;US)
Laser Program annual report 1984, 11:12505 (R;US)
Lawrence Livermore National Laboratory Granular Flow Project. Quarterly report, October-December 1985, 11:11764 (R;US)
Monte Carlo particle simulation and finite-element techniques for tandem mirror transport, 11:12456 (R;US)
Multiprocessor model with distributed task creation, 11:12524 (R;US)
Neutron activation in Cascade: the $BeO/LiAlO_2$ case, 11:12507 (R;US)
New method of synthesizing stilbene compounds with heterocyclic substituents, anil synthesis, 11:11698 (TJ;US)
Operating experience with the Livermore solid-recycle retort system, 11:10970 (R;US)
Plasma physics modeling and the Cray-2 multiprocessor, 11:12457 (R;US)
Seismicity rates for East Bay faults, 11:12032 (R;US)
Stress analysis of the ROQUEFORT diagnostic canister by finite-element method, 11:11749 (R;US)
Summary report on the Seismic Safety Margins Research Program, 11:11338 (R;US)
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Lehigh Univ., Bethlehem, PA (USA)
Analytical electron microscopy studies of precipitation in ceramic systems, 11:11558 (R;US)
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Calculation of sliding interfaces of two-dimensional unsteady flow, 11:11767 (TG;US)

CFT compiler optimization and Cray X-MP vector performance, 11:12522 (R;US)
Comparison of models for the free-free Gaunt factor at low temperatures and frequencies, 11:12384 (R;US)
Current operations and experiments at the Tritium Systems Test Assembly, 11:12495 (R;US)
2-D Eulerian hydrodynamics with fluid interfaces, self-gravity and rotation, 11:12042 (R;US)
Determination of the neutron lifetime using e-p coincidence, 11:12162 (R;US)
Elements of a dialogue between nonlinear models in condensed matter and biophysics, 11:12088 (R;US)
FACOM VP supercomputer of parallel pipeline processing system has achieved 7.5 ns machine cycle, 11:12525 (TG;US)
Few-body strange systems, 11:12372 (R;US)
Hausdorff dimensions for sets with broken scaling symmetry, 11:12420 (R;US)
Improved Monte Carlo Renormalization Group Method, 11:12252 (R;US)
Model for optical-laser-induced impulse in vacuo, 11:12496 (R;US)
Potential application of fuel cells in the chlor-alkali industry, 11:11410 (R;US)
Present status of hot dry rock technology, 11:11201 (R;US)
Problems associated with dimensional analysis of electroencephalogram data, 11:11978 (R;US)
Proceedings of the LAMPF workshop on pion double charge exchange, 11:12281 (R;US)
Rossi Alpha Method, 11:11284 (R;US)
Scaling in fat fractals, 11:12521 (R;US)
Studies of nuclear structure via polarization transfer experiments, 11:12282 (R;US)
Thermal transport: a comparison between solid and shell targets, 11:12490 (R;US)
Uranium isotope separation by magnetic field gradient and visible light acting in a liquid medium, 11:10980 (TG;US)

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Activation measurements of neutron-capture cross sections in the MeV region, 11:11616 (R;SE)
Neutron-capture cross-section measurements for ^{115}In and ^{197}Au in the energy region 2.0-7.7 MeV, using the activation technique, 11:12331 (R;SE)

Lyon-1 Univ., 69 - Villeurbanne (France)
Capabilities of light element surface analysis by nuclear microanalysis, 11:11617 (R;FR;In French)
Real and virtual pions in nuclei, 11:12287 (R;FR;In French)

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Capabilities of light element surface analysis by nuclear microanalysis, 11:11617 (R;FR;In French)
Constraint quantization: case of the hydrogen atom, 11:12089 (R;FR;In French)
Real and virtual pions in nuclei, 11:12287 (R;FR;In French)

M

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Non-thermal electron velocity distribution measured by electron cyclotron emission in Alcator C tokamak, 11:12446 (R;US)

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Dosimetric aspects, 11:12003 (BA;US)
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Identification of state-level energy data available from the Energy Information Administration, Private Sector Sources, and State Offices, 11:11393 (R;US)

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Process design criteria for a plant producing nitrogen-15, 11:11112 (R;US)
Renovation of DOT specification 21PF-1 protective shipping packages, 11:11746 (R;US)

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Amorphization and recrystallization processes in monocrystalline beta silicon carbide thin films, 11:11555 (R;US)
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Atomic effects of electrons and protons at low energies, 11:12066 (R;US)
BTESM National Program: past, present, and future, 11:11418 (R;US)
Calculational methods for analysis of postulated UF_6 releases. Volume 2, 11:11078 (R;US)
Carbon Dioxide Information Center FY 1985 progress report, 11:11867 (R;US)
Cascade-induced fluctuations and the transition from the stable to the critical cavity radius for swelling, 11:11510 (R;US)
Characterization plan for Solid Waste Storage Area 6, 11:11027 (R;US)

Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)
Comparative measurement of the neutral density and particle confinement time in EBT, 11:12444 (R;US)
Configuration and structural design of Compact Ignition Tokamak, 11:12482 (R;US)
Coupling of carbon, water, and nutrient interactions in woody plant soil systems. Program and presentation summaries, 11:11162 (R;US)
Data acquisition and testing at the Tennessee Energy Conservation in Housing (TECH) complex, 11:11442 (R;US)
Determinants of actual electricity savings after retrofit: electrically heated homes in the Pacific Northwest, 11:11420 (R;US)
Detoxication mechanisms of benzo(a)pyrene as studied in the CHO/HGPRT assay, 11:12006 (R;US)
Development and applications of two finite element groundwater flow and contaminant transport models: FEWA and FEMA, 11:11058 (R;US)
Dynamic thermal performance of light weight insulated low-slope roof systems, 11:11419 (R;US)
Effects of an alpha particle slowing-down distribution on tokamak ballooning modes, 11:12443 (R;US)
Effects of helium content of microstructural development in Type 316 stainless steel under neutron irradiation, 11:11525 (R;US)
Effects of rapidly pulsed ion bombardment on microstructure and phase stability in a Ti-modified stainless steel, 11:11509 (R;US)
Emergency diesel generator operating experience, 1981-1983, 11:11235 (R;US)
Evaluation of uranium and plutonium internal standards, 11:11619 (R;US)
Factors affecting the rent to surface-mined coal tracts in the Powder River Basin and Green River/Hams Fork Region, 11:10918 (R;US)
Features of spherical torus plasmas, 11:12442 (R;US)
Formaldehyde emissions from fibrous glass insulation products, 11:11865 (R;US)
Guidance document for prioritizing supplemental monitoring around synfuels facilities, 11:10922 (R;US)
Hardness of ion implanted ceramics, 11:11556 (R;US)
High Energy Transport Code HETC, 11:12373 (R;US)
High Flux Isotope Reactor quarterly report, July-September 1985, 11:11290 (R;US)
High Flux Isotope Reactor technical specifications, 11:11289 (R;US)
Highlights from the assembly of the helical field coils for the Advanced Toroidal Facility, 11:12480 (R;US)
Hoisting and rigging of critical components and related equipment. Revision, 11:11274 (R;US)
Hydrogen bonding patterns and dynamics in biological macromolecules, 11:11946 (R;US)
Hydrogen-induced reconstruction of stepped W(001) surfaces studied with LEED and EELS, 11:11506 (R;US)
ICRF antenna and feedthrough development at ORNL, 11:12428 (R;US)
Implementation and operation of VAX-based data acquisition system for the large coil task, 11:12477 (R;US)
Integrated Tiger Series of electron/photon Monte Carlo transport codes: a user's guide for use on IBM mainframes, 11:12386 (R;US)
Introduction to panel on "Where do we go from here", 11:11268 (R;US)
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Linkages in hierarchical models, 11:11893 (R;US)
Maintenance Personnel Performance Simulation (MAPPS) model. Users' Manual, 11:11328 (R;US)
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MELRPI - development and use, 11:11301 (R;US)
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ORNL facilities for testing first-wall components, 11:12479 (R;US)
ORVIRT.PC: a 2-D finite-element fracture analysis program for a microcomputer, 11:11236 (R;US)
Perspective on present and future alloy development efforts on austenitic stainless steels for fusion application, 11:11507 (R;US)
Physical and chemical events that follow the passage of a charged particle in liquid water, 11:12389 (R;US)
Physics parameter space of tokamak ignition devices, 11:12429 (R;US)
Prediction of flow rates through an orifice at pressures corresponding to the transition between molecular and isentropic flow, 11:11763 (R;US)
Preliminary radiation protection tests for the body height and body weight of the Chinese reference man, 11:12394 (TG;US)
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Pure mode swept frequency TE_{02} measurements in 6.35 cm circular waveguide, 11:12484 (R;US)
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Stability and composition of palm, coconut and soy oil fatty acid microemulsion diesel fuels, 11:11499 (R;US)
Stable isotope inventory requirements and enrichment capabilities, 11:11113 (R;US)
Statistically based parametric analysis of exterior envelope thermal mass effect predictions, 11:11417 (R;US)
Structurally modified fatty acids - clinical potential as tracers of metabolism, 11:11972 (R;US)
Study of current and planned high occupancy vehicle lane use: performance and prospects, 11:11462 (R;US)
Summary of studies on methods for detecting, locating, and characterizing metallic loose parts in nuclear reactor coolant systems, 11:11229 (R;US)
Superconducting magnet research and development program, 11:12483 (R;US)
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1985, 11:10790 (R;US)
Surface-enhanced Raman spectroscopy: a new tool for chemical detection, 11:11608 (R;US)
Temperature dependent electron transport studies for diffuse discharge switching applications, 11:11770 (R;US)
Thermal conductivities of U_3Si and U_3Si_2-Al dispersion fuels, 11:11280 (R;US)
Thermal conductivities of Wilsonville solvent and Wilsonville solvent/Illinois No. 6 coal slurry, 11:10791 (R;US)
Thermal reactor design for a neutron scattering source facility, 11:11287 (R;US)
Time-resolved reflectivity measurements of silicon and germanium pulsed excimer laser irradiation, 11:11576 (R;US)
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Transmission measurements of selected liquids in the far infrared, 11:12445 (R;US)
Ultimate Safe (US) Reactor, 11:11300 (R;US)

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Coal conversion (liquefaction/gasification): engineering considerations and relationships among physical, chemical and toxicological properties of resulting materials, 11:10793 (R;US)

Comparative biology and chemistry of boiling point fractions from different coal liquefaction processes, 11:10927 (R;US)

Comparison of a multilayer regional-scale acid rain assessment model (MLRAPT) with a single-layer assessment model, RAPT, 11:11872 (R;US)

Decommissioning a boiling water reactor nuclear power plant, 11:11339 (R;US)

Determination of radical initiating and hydrogen donating properties of coal liquefaction process solvents by reaction with fluorenone, 11:10792 (R;US)

Economic evaluations of solar thermal energy systems using a levelized energy cost approach, 11:11177 (R;US)

Electrochemical development of particle tracks in CR-39 polymer dosimeter, 11:11836 (R;US)

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Factors affecting the assessment of lung depositions of transuranics, 11:12000 (R;US)

Guidelines for preparing emergency procedures for nuclear power plants, 11:11327 (R;US)

Hydrothermal studies of simulated defense waste glass plus basalt, 11:11030 (R;US)

Identifying barriers to the commercialization of low-Btu gasifiers, 11:11144 (R;US)

Instrumentation for remote monitoring and control of liquid-fed ceramic melters, 11:11028 (R;US)

Introduction to the USUR data, 11:12001 (R;US)

Low-temperature thermochemical conversion of high-moisture biomass feedstocks, 11:11132 (R;US)

Measurement and prediction of sensitization development in austenitic stainless steels, 11:11526 (R;US)

Methodologies for the separation of chemical classes from coal liquefaction materials, 11:10928 (R;US)

Objective indicators of organizational performance at nuclear power plants, 11:11335 (R;US)

On-line acoustic emission monitoring of nuclear reactor systems: status and future, 11:11270 (R;US)

Organohalogens in chlorinated cooling waters discharged from nuclear power stations, 11:11255 (R;US)

Probabilistic risk assessments modeled on a micro-computer, 11:11342 (R;US)

Project summaries: seventh battery and electrochemical contractors' conference, 11:11365 (R;US)

Protection of uranium tailings impoundments against overland erosion, 11:11026 (R;US)

Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)

Results from the long-term interaction and modeling of SRL-131 glass with aqueous solutions, 11:11060 (R;US)

Spent fuel performance in geologic repository environments, 11:11029 (R;US)

Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)

Surry steam generator - examination and evaluation, 11:11256 (R;US)

Technique for comparing AES signals from different spectrometers using common materials, 11:11621 (R;US)

Trends in thermal calculations for light water reactor fuel (1971-1981), 11:11238 (R;US)

Use of fuel-thermocouple scram response for data verification, 11:11237 (R;US)

Viabilities and mutation frequencies of CHO-K1 cells following exposure to 60-Hz electric fields, 11:12025 (R;US)

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Conventional Hamiltonian for first-order differential systems, 11:12413 (R;BR)
Generalized Euler's formula from Poisson's summation formula and some applications, 11:12412 (R;BR)
Influence of cusps and intersections on the calculation of the Wilson loop in ν-dimensional space, 11:12257 (R;BR)
Laser theory in the absence of adiabatic hypothesis: linear approximation, 11:12411 (R;BR)
Quantum theory of a one-dimensional laser with output coupling. 2. Nonlinear theory, 11:12410 (R;BR)
Some remarks about the classical Wilson loop for a class of gauge field copies, 11:12256 (R;BR)
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From baryonium to hexons, 11:12194 (R;FR)
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Off-shell properties of the Paris nucleon-nucleon potential and implications for few-body systems, 11:12193 (R;FR)
Relativistic wave equations for two interacting particles and zero mass bound states, 11:12192 (R;FR)
Spin dependent NN and N anti N interaction from the Paris potential, 11:12157 (R;FR)
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Equilibrium fluctuation energy of gyrokinetic plasma, 11:12451 (R;US)
Feedback control of resistive instabilities, 11:12449 (R;US)
Fokker-Planck and quasilinear codes, 11:12453 (R;US)
Low-n shear Alfven spectra in axisymmetric toroidal plasmas, 11:12452 (R;US)
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HEADCO: a program for converting observed water levels and pressure measurements to formation pressure and standard hydraulic head, 11:12030 (R;US)
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Binary and ternary amorphous alloys of ion-implanted Fe-Ti-C, 11:11527 (R;US)
Combined experimental/analytical modeling of shell/payload structures, 11:11742 (R;US)
Core material redistribution accompanying accident sequences leading to degraded cores, 11:11346 (R;US)
Current neutralization of intense light ion beams in argon gas, 11:12502 (R;US)
Design of a low-noise fiber-optic transmitter module, 11:11774 (R;US)
Effective heat transfer in the Strategic Petroleum Reserve porous media, 11:10956 (R;US)
Effects of reactor core-simulant aerosols on hydrogen/air combustion, 11:11349 (R;US)
Effects of thermal donor generation and annihilation upon oxygen precipitation, 11:11587 (R;US)
Evaluation of the bases for estimating alpha-mode failure probabilities, 11:11350 (R;US)
Exact integration algorithm for use with modal analysis, 11:11743 (R;US)
Experimental study of the performance of clustered parachutes in a low-speed wind tunnel, 11:11741 (R;US)
Exploratory Battery Technology Development and Testing report for 1984, 11:11372 (R;US)
Field test of drag reducing agents in a three-inch pipeline at the West Hackberry, Louisiana SPR site, 11:10957 (R;US)
Formation of surface layers of icosahedral Al(Mn), 11:11528 (R;US)
Infrared thermography of first wall components on TMX-U, 11:12501 (R;US)
ISHTE: component test cruise report. In Situ Heat Transfer Experiment (Atlas Cruise, Leg 1), September 1984, 11:11039 (R;US)
MELPROG analysis of the DF-1 severe core damage experiment, 11:11352 (R;US)
NEPTUNE: a finite element code for creeping flow of saturated cohesive porous media (Version 1.0), 11:12035 (R;US)
Observations regarding the stability of bentonite backfill in a high-level waste (HLW) repository in rock salt, 11:11585 (R;US)
Optical imaging of dislocations in strained-layer superlattices and lattice-mismatched epilayers, 11:11588 (R;US)
Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)
Potential effect of water influx on the dissolution rate of UO_2 in spent fuel at the Yucca Mountain, Nevada site, 11:11559 (R;US)
Pressure-dependent magneto-optic measurements in strained-layer superlattices at low temperatures, 11:11586 (R;US)
Probabilistic risk assessment of filtered-vented containment systems. Mark I BWR, 11:11345 (R;US)
Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)
RDEAM: an Adams ODE code with root solving capability, 11:12523 (R;US)
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Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels, 11:11348 (R;US)
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Rectangular plate is proposed as an IES modal test structure, 11:11748 (R;US)
SMOKE: a data reduction package for analysis of combustion experiments, 11:11740 (R;US)
TRAC-PF1/MOD 1 independent assessment: Semiscale MOD-2A feedwater-line break (S-SF-3) and steam-line break (S-SF-5) tests, 11:11331 (R;US)

TRAC-PF1/MOD1 independent assessment: LOBI large break transient A1-04R, 11:11330 (R;US)
Two-dimensional empirical model for analyzing steam explosion experiments, 11:11344 (R;US)
Uniaxial and triaxial compression test series on two types of foundry stone, 11:11038 (R;US)
Uniaxial and triaxial compression test series on Topopah Spring Tuff from USW G-4, Yucca Mountain, Nevada, 11:12033 (R;US)
Value impact assessment of standard review plan sections, 11:11347 (R;US)

Sandia National Labs., Livermore, CA (USA)
Crystal plasticity analysis of large-strain shear, 11:11529 (R;US)
Numerical modeling of a solid particle solar central receiver, 11:11178 (R;US)
TOPAZ - the transient one-dimensional pipe flow analyzer: equations and numerics, 11:12132 (R;US)

Sao Paulo Univ. (Brazil). Inst. de Fisica
Anomalous Z^0 decay and a stronger coupled Higgs boson, 11:12185 (R;BR)
Asymptotic behavior of quark masses induced by instantons, 11:12184 (R;BR)
Back-angle scattering of antiprotons from nuclei, 11:12301 (R;BR)
Bound-states of N particles: a variational approach, 11:12407 (R;BR)
Decay rate of the false vacuum at high temperatures, 11:12236 (R;BR)
Deformation effects in the heavy ion quarter-point angle, 11:12367 (R;BR)
Description of antiproton-nucleus scattering with the proton-nucleus Dirac impulse approximation optical potential, 11:12300 (R;BR)
Dynamics of the nuclear one-body density: small amplitude regime, 11:12406 (R;BR)
Effect of collisions on the mechanism of isotope separation by ion-cyclotron waves, 11:12441 (R;BR)
Effects of the dynamic α-transfer polarization potential in the large-angle scattering of $^{16}O + ^{28}Si$, 11:12315 (R;BR)
Forced harmonic oscillator with damping and thermal effects, 11:12405 (R;BR)
Formation of structures in the very early universe, 11:12040 (R;BR)
Gentilion hypothesis for quark colours, 11:12239 (R;BR;In Portuguese)
Gentilionic approach to quark colours, 11:12238 (R;BR)
Grassmann-Schoenberg algebras and grand unification, 11:12240 (R;BR;In Portuguese)
Homotopy and statistics in quantum theory, 11:12404 (R;BR)
Intermediate energy nucleon-nucleus total reaction cross section in the Dirac phenomenology, 11:12318 (R;BR)
^{24}Mg yrast sequence up to 30 MeV excitation, 11:12314 (R;BR)
Near/far decomposition of the proton-nucleus and antiproton-nucleus elastic scattering angular distributions, 11:12320 (R;BR)
New contributions to the cosmological constant, 11:12041 (R;BR)
New weak boson decays and possible spin 3/2 leptons, 11:12186 (R;BR)
Non-electric-dipole photofission of ^{235}U, 11:12352 (R;BR)
Observation of M1 strength in the photofission of actinide nuclei, 11:12353 (R;BR)
Percolation temperature and the 'instability' of the effective potential, 11:12237 (R;BR)
Phenomenological renormalization group calculations for 12- and 16- vertex models on a square lattice, 11:12397 (R;BR)
Phosphorescence in irradiated spodumene, 11:11582 (R;BR)
Photoneutron cross sections, 11:12334 (R;BR)
Photonuclear physics at intermediate energies, 11:12365 (R;BR;In Portuguese)
Polarization potentials in heavy ion scattering, 11:12364 (R;BR)
Quantization of the fermionic sector in N=1, D=11 supergravity, 11:12241 (R;BR)
Reactive content of the proton-nucleus impulse - approximation Dirac optical potential, 11:12319 (R;BR)
Resolution of hydrodynamical equations for transverse expansions. Part 1, 11:12130 (R;BR)
Resolution of hydrodynamical equations for transverse expansions. Part 2, 11:12131 (R;BR)
Role of peripheral partial waves in the anomalous large angle scattering of n-α nuclei, 11:12366 (R;BR)
Statistical decay of giant monopole resonance in ^{208}Pb, 11:12343 (R;BR)
Study on particle emission in the light-heavy ion fusion reactions: ^{14}N, sup(16,18) O + ^{13}C, 11:12299 (R;BR)
sup(10,11) B(p, n) sup(10,11) C reaction between E sub(p) = 13.6 and 14.7 MeV, 11:12298 (R;BR)
Theory of the heavy ion fusion cross section, 11:12363 (R;BR)
Transitions in a lyomesophase: a study by thermal analysis and electron microscopy, 11:11581 (R;BR)
Use of energy-averaged cross sections for nuclear spectroscopy: ^{26}Mg states in the continuum, 11:12313 (R;BR)

Savannah River Ecology Lab., Aiken, SC (USA)
Ecological research at the Savannah River Ecology Laboratory. Annual report for the period ending July 31, 1985, 11:11921 (R;US)

Senes Consultants, Willowdale, Ontario (Canada)
Computer modelling of an underground mine ventilation system, 11:10977 (R;CA)

Shoshone Irrigation District, Powell, WY (USA)
Garland Canal Shoshone Irrigation District hydroelectric project: final operations and maintenance report. Small-Scale Hydroelectric Power Demonstration Project, 11:11152 (R;US)

SIA Ltd., London (UK)
Elasto-plastic creep analysis of an exisymmetric shell subject to pure thermal loading, 11:11744 (R;GB)

Sigma Research, Inc., Richland, WA (USA)
Optical temperature sensors for transformers. Final report, 11:11771 (R;US)

Siltec Corp., Mountain View, CA (USA)
Effects of thermal donor generation and annihilation upon oxygen precipitation, 11:11587 (R;US)

Simon Fraser Univ., Burnaby, British Columbia (Canada)
Methods for on-line production of radioactive ion-beams in the $2 < Z < 21$ region, 11:12065 (R;CH)

Simon Fraser Univ., Burnaby, British Columbia (Canada). Dept. of Physics
Nuclear liquid-gas phase transition, 11:12374 (R;CA)

Skidaway Inst. of Oceanography, Savannah, GA (USA)
Biological processes in the water column of the South Atlantic Bight: zooplankton responses. Progress report, June 1985-June 1986, 11:11906 (R;US)
Coordination: Southeast continental shelf studies. Progress report, 1 June 1984-31 December 1985, 11:12034 (R;US)
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, 1 December 1984-30 November 1985, 11:11859 (R;US)
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, 1 Dec 1984-30 November 1985, 11:11905 (R;US)
Trace element geochemistry of the South Atlantic Bight. Progress report, 11:11907 (R;US)

Sloan-Kettering Inst. for Cancer Research, New York (USA)
Biochemical studies on the mechanism of benzo(a)pyrene binding to cellular macromolecules. Progress report, 11:12007 (R;US)
[Templates, site specifically modified with carcinogens]. Final report, 11:11947 (R;US)

Solarex Corp., Newtown, PA (USA)
Research on high-efficiency, single-junction, monolithic, thin-film a-Si solar cells. Annual subcontract progress report, 1 February 1984-31 January 1985, 11:11165 (R;US)

Southampton Univ. (UK)
Comparison of retrospective testing with statistical tests in near real time materials accountancy, 11:11084 (R;GB)

Southeastern Massachusetts Univ., North Dartmouth (USA)
Partial wave analysis of KKPI system in D and E/IOTA region, 11:12140 (R;US)

Southwest Research Inst., San Antonio, TX (USA)
Characterization of exhaust emissions from alcohol-fueled vehicles. Final report, 11:11498 (R;US)
Effects of 60 Hz electric fields on operant and social stress behavior of nonhuman primates. Quarterly technical progress report No. 20, September 28-December 20, 1985, 11:12016 (R;US)

Southwest Research Inst., San Antonio, TX (USA). Fuels and Lubricants Research Div.
Synthetic Fuel Center operation. Monthly progress report No. 2, 1-31 December 1985, 11:11502 (R;US)

Spire Corp., Bedford, MA (USA)
Research on high-efficiency, stacked, multijunction, amorphous silicon alloy thin-film solar cells. A semiannual subcontract progress report, 1 October 1984-15 May 1985, 11:11169 (R;US)

SRI International, Menlo Park, CA (USA)
Sodium chloride as a catalyst for the gasification of coal char. Final report, Tasks 8 and 9, 11:10741 (R;US)

Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)
Safety assessment of underground nuclear waste repositories using the method of status vectors, 11:11035 (R;DD;In German)
Safety assessment of underground nuclear waste repositories using the method of status vectors, 11:11035 (R;DD;In German)

Stanford Linear Accelerator Center, Menlo Park, CA (USA)
Emittance growth from radiation fluctuations, 11:11790 (R;US)
Study of hadronization using energy flow from e^+e^- annihilation into quarks and gluons at $\sqrt{s}$ of 29 GeV, 11:12163 (R;US)

Stanford Univ., CA (USA)
Investigation of fluid-bed combustion of municipal solid waste, 11:11483 (R;US)

State Univ. of New York, Buffalo (USA). Dept. of Chemistry
Determination of gaseous hydrogen sulfide by cathodic stripping voltammetry after preconcentration on a silver metalized porous membrane electrode, 11:11602 (R;US)

State Univ. of New York, Stony Brook (USA). Health Science Center
Cation shifts in human retina-choroid, 11:11965 (R;US)

Stockholm Univ. (Sweden). Inst. of Physics
Identification of neutral Higgs bosons in the Delphi detector at Lep, 11:12211 (R;SE)

Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires
Fission-like phenomena for systems with mass A=110, 11:12312 (R;FR)

Supercon, Inc., Natick, MA (USA)
Development of high field superconductors for fusion energy applications. Progress report, 9/1/83-11/30/83, 11:11515 (R;US)

Supercon, Inc., Shrewsbury, MA (USA)
Development of high field superconductors for fusion energy applications. Progress report, August 1, 1984-January 15, 1985, 11:11514 (R;US)

Swedish Nuclear Fuel and Waste Management Co., Stockholm
Final report of the migration in a single fracture - experimental results and evaluation, 11:11903 (R;SE)
Stripa project quarterly report. October through December 1984, 11:11023 (R;SE)

T

Technische Univ., Dresden (German Democratic Republic). Sektion Physik
Safety assessment of underground nuclear waste repositories using the method of status vectors, 11:11035 (R;DD;In German)

Tennessee Technological Univ., Cookeville (USA). Dept. of Physics
Research in nuclear physics. Progress report, April 1, 1985-March 31, 1986, 11:12297 (R;US)

Tennessee Univ., Knoxville (USA). Dept. of Chemical Engineering
Prediction of flow rates through an orifice at pressures corresponding to the transition between molecular and isentropic flow, 11:11763 (R;US)

Tennessee Univ., Knoxville (USA). Dept. of Physics
First results from the UNISOR collinear laser facility, 11:12067 (R;US)

Texas A and M Univ., College Station (USA). Dept. of Chemistry
Investigations on multiphoton ionization and laser-ion beam photodissociation spectroscopy. Final report, 11:11702 (R;US)

Texas A and M Univ., College Station (USA). Dept. of Oceanography
Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)

Texas Tech Univ., Lubbock (USA)
Biomechanical and work physiology study in underground mining, excluding low coal. Open file report, 25 January 1980-22 July 1984, 11:12027 (R;US)
Laser induced coal fluorescence. Twelfth quarterly technical progress report, July 1-September 31, 1985, 11:10798 (R;US)

Texas Univ., Arlington (USA). Dept. of Chemistry
Electrodeposition of p-CdTe and CdS/CdTe heterojunction devices. Final subcontract report, September 1983-May 1985, 11:11589 (R;US)

Texas Univ., Austin (USA)
Analysis of the potential for enhanced oil recovery in the Shannon Formation at Naval Petroleum Reserve Number 3. Master's thesis, 11:10930 (R;US)
Existence and calculation of sharp boundary MHD equilibrium in three-dimensional toroidal geometry, 11:12436 (R;US)
Renormalized turbulence theory of ion pressure gradient driven drift modes, 11:12432 (R;US)
Research in experimental nuclear physics. Progress report, 1 April 1985-31 March 1986, 11:12296 (R;US)

Texas Univ., Austin (USA). Dept. of Physics
Kinetic studies following state selective laser excitation. Progress report, March 15, 1985-March 14, 1986, 11:12078 (R;US)

Texas Univ., Austin (USA). Inst. for Fusion Studies
Destabilization of MHD modes with finite Larmor radius effects in tandem mirrors, 11:12438 (R;US)
Dynamics and fluctuation spectra of electrostatic resistive interchange turbulence, 11:12437 (R;US)
Effect of toroidicity during lower hybrid mode conversion, 11:12433 (R;US)
Electromagnetic solitary vortices in rotating plasma, 11:12435 (R;US)
Muon catalyzed fusion - fission reactor driven by a recirculating beam, 11:12494 (R;US)
Spontaneous symmetry breaking and neutral stability in the noncanonical Hamiltonian formalism, 11:12434 (R;US)

Thermo Electron Corp., Waltham, MA (USA)
Ceramic heat pipe waste heat recovery. Phase I report, August 1, 1984-April 30, 1985, 11:11477 (R;US)

Triangle Universities Nuclear Lab., Durham, NC (USA)
Triangle Universities Nuclear Laboratory annual report - TUNL XXIV, 1 July 1984-31 August 1985, 11:12275 (R;US)

TRIUMF, Vancouver, British Columbia (Canada)
Angular dependence of the sup(6)Li(πsup(+), sup(3)He)sup(3)He reaction, 11:12304 (R;CA)
CP violation with three generations of Majorana neutrinos, 11:12207 (R;CA)
Effects of anomalous Zsup(O) decays on neutrino counting near the Zsup(O), 11:12255 (R;CA)
Fluorination of aromatic compounds with F_2 and acetyl hypofluorite. Synthesis of ^{18}F-aryl fluorides by cleavage of aryl-tin bonds, 11:11724 (R;CA)
FORTRAN program (RELAX3D) to solve the 3 dimensional Poisson (Laplace) equation, 11:12409 (R;CA)
Inclusive measurement of (p,πsup(-)xn) double charge exchange reactions on bismuth from threshold to 800 MeV, 11:12344 (R;CA)
Lattice results on the meson electric form factor, 11:12254 (R;CA)
Muonium addition reactions to aromatic solutes. Application of the Hammett equation in the production of muonium-radicals, 11:12090 (R;CA)
Muonium formation in vapors, 11:12091 (R;CA)
Polarized proton induced pion production on ^{10}B at 200, 225, 250 and 260 MeV incident energies, 11:12305 (R;CA)
Potential model for quark confinement, 11:12253 (R;CA)
Rare decays of neutral π and eta, 11:12206 (R;CA)
Rate suppression with three generations of Majorana neutrinos, 11:12208 (R;CA)
Survey of the cleavage of aryl-metal bonds by elemental fluorine. Synthesis of aryl-fluorides, 11:11723 (R;CA)

TRW, Inc., Redondo Beach, CA (USA)
Confinement by axisymmetric mirror configuration. Quarterly progress in STM program, July-September 1985, 11:12431 (R;US)

Tufts Univ., Medford, MA (USA). Dept. of Physics
Renormalization scheme-dependence of perturbative quantum chromodynamics corrections to quarkonia, 11:12226 (R;US)

Tulsa Univ., OK (USA). Dept. of Mechanical Engineering
Stimulation model for lenticular sands: Proppant transport model. Phase I annual report. Final report, 11:10965 (R;US)

U

UCC Research Corp., Bristol, VA (USA)
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, January-March 1985, 11:10854 (R;US)
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, July-September 1985, 11:10855 (R;US)

UKAEA Atomic Energy Establishment, Winfrith
Comparison of retrospective testing with statistical tests in near real time materials accountancy, 11:11084 (R;GB)
Investigation of non-destructive techniques for the examination and quality assurance of cemented radioactive waste. Final report, 11:10994 (R;GB)

UKAEA Atomic Energy Research Establishment, Harwell
Neutron scattering and reactions on 59Co from 1 to 20 MeV, 11:12323 (R;GB)

UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.
Calculated solubilities of actinides and some fission and activation products under disposal conditions, 11:10996 (R;GB)

UKAEA Atomic Energy Research Establishment, Harwell. Safeguards R and D Project
Comparison of retrospective testing with statistical tests in near real time materials accountancy, 11:11084 (R;GB)

UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.
Specification of a test problem for HYDROCOIN Level 1 Case 4: transient thermal convection in a saturated permeable medium, 11:10995 (R;GB)

UKAEA Risley Nuclear Power Development Establishment
Fast reactor status review. Development work on core protective instrumentation, 11:11358 (TJ;GB)

UKAEA Safety and Reliability Directorate, Culcheth
Cascade-induced fluctuations and the transition from the stable to the critical cavity radius for swelling, 11:11510 (R;US)

United Technologies Corp., South Windsor, CT (USA). Power Systems Div.
Onsite 40-kilowatt fuel cell power plant manufacturing and field test program, 11:11409 (R;US)

United Technologies Research Center, East Hartford, CT (USA)
Kinetics of coal pyrolysis and devolatilization. Technical progress report, August 1, 1985-October 31, 1985, 11:10784 (R;US)

Universidade Estadual de Campinas (Brazil). Inst. de Fisica
Estimation of the measurement effective point in cylindrical ionization chamber used in electron beams with energies between 6 and 20 MeV, 11:11846 (R;BR;In Portuguese)

University of Southern California, Los Angeles (USA)
Microbial screening test for lignite degradation. Quarterly progress report No. 4, October-December 1985, 11:10799 (R;US)

University of Southern Mississippi, Hattiesburg (USA). Dept. of Biological Sciences
Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico). Grass shrimp, 11:11910 (R;US)

USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Vehicle and Engine Research and Development
Twenty-second automotive technology development contractors' coordination meeting: proceedings, 11:11485 (R;US)

USDOE Assistant Secretary for Defense Programs, Washington, DC. Defense Waste and Byproducts Div.
Evaluation of "Commercial Repository Capacity for the Disposal of Defense High-Level Waste." Response to comments, 11:10999 (R;US)

USDOE Assistant Secretary for Fossil Energy, Washington, DC. Strategic Petroleum Reserve Program Office
Strategic Petroleum Reserve: site expansion alternatives to the development of the Big Hill site, 11:10955 (R;US)

USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Project and Facilities Management
Ten-Year Inhouse Energy Management Plan, 11:11444 (R;US)

USDOE Assistant Secretary for Management and Administration, Washington, DC. Procurement and Assistance Management Directorate
Department of Energy Annual Procurement and Federal Assistance report, FY 1985, 11:12512 (R;US)

USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Remedial Action and Waste Technology
Annual status report on the Uranium Mill Tailings Remedial Action Program, 11:11003 (R;US)

USDOE Energy Information Administration, Washington, DC
Weekly coal production, January 4, 1986, 11:10816 (R;US)
Weekly Petroleum Status Report. Data for week ended: January 3, 1986, 11:10935 (R;US)

USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels
Coal distribution, January-September 1985, 11:10815 (R;US)

USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use
Monthly Energy Review, September 1985, 11:10933 (R;US)

USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas
Natural Gas Annual, 1984. Volume I, 11:10962 (R;US)
Natural Gas Annual 1984. Volume II, 11:10963 (R;US)
Natural Gas Monthly, October 1985, 11:10961 (R;US)
Petroleum Supply Monthly, October 1985, 11:10934 (R;US)

USDOE Morgantown Energy Technology Center, WV
Surface gasification data system: feasibility studies overview report, 11:10778 (R;US)

USDOE Office of Civilian Radioactive Waste Management, Washington, DC
Implementation plan for deployment of Federal Interim Storage facilities for commercial spent nuclear fuel, 11:10990 (R;US)
Information Services Directory, 11:11006 (R;US)
Managing the nation's nuclear waste. Overview: Nuclear Waste Policy Act, 11:11081 (R;US)
Managing the nation's nuclear waste. Site descriptions: Cypress Creek, Davis Canyon, Deaf Smith, Hanford Reference, Lavender Canyon, Richton Dome, Swisher, Vacherie Dome, and Yucca Mountain, 11:11007 (R;US)
Program Management System manual, 11:11008 (R;US)

USDOE Office of Energy Research, Washington, DC
Anaerobic biogeochemical processes in the subsurface. Subsurface transport program, interactive seminar series, 11:11894 (R;US)
Nuclear physics program plan, 11:12274 (R;US)

USDOE Office of Energy Research, Washington, DC. High Energy Physics Div.
Report of the HEPAP Subpanel on Advanced Accelerator R and D and the SSC, 11:11784 (R;US)

USDOE Office of Inspector General, Albuquerque, NM. Office of Audits
Audit of joint owner costing and billing practices, Naval Petroleum Reserve No. 1, Elk Hills, California, 11:12515 (R;US)

USDOE Pittsburgh Energy Technology Center, PA
Annotated bibliography of US government coal preparation publications, 1910-1984, 11:10859 (R;US)
Flow characteristics of coal-water mixtures. Final report, September 1, 1981-September 30, 1984, 11:10912 (R;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)

V

Valtion Teknillinen Tutkimuskeskus, Helsinki (Finland)
Review of the models and mechanisms for environmentally-assisted crack growth of pressure vessel and piping steels in PWR environments, 11:11524 (R;US)

Vanderbilt Univ., Nashville, TN (USA). Dept. of Computer Science
Theoretical studies of atomic transitions. Progress report, March 15, 1985-March 14, 1986, 11:12077 (R;US)

Verein Deutscher Ingenieure (VDI), Duesseldorf (Germany, F.R.). Fachgruppe Landtechnik
Agricultural technology, 11:11463 (R;DE;In German and English)

Vienna Univ. (Austria). 1. Medizinische Klinik
Structurally modified fatty acids - clinical potential as tracers of metabolism, 11:11972 (R;US)
Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Materials Engineering
VPI-3 alkali attack of coal gasifier refractory linings. Progress report No. 4, October 1-December 31, 1985, 11:10779 (R;US)
Virginia Univ., Charlottesville (USA)
Linkages in hierarchical models, 11:11893 (R;US)
Virginia Univ., Charlottesville (USA). Dept. of Physics
Spectroscopy of surface adsorbed molecules (scanning tunneling microscopy). Progress report, May 1, 1985-April 30, 1986, 11:12396 (R;US)

W

Warren Spring Lab., Stevenage (UK)
Use of airborne microwave radiometry for the detection and investigation of oil slicks at sea, 11:10939 (R;US)
Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej
Hydrogen bonding patterns and dynamics in biological macromolecules, 11:11946 (R;US)
Washington State Univ., Pullman (USA). Dept. of Mechanical Engineering
Numerical modeling of a solid particle solar central receiver, 11:11178 (R;US)
Washington Univ., Seattle (USA)
NERC summary load forecasts: a retrospective appraisal and technical analysis. Final report, 11:11400 (R;US)
Quarks and nuclear properties, 11:12362 (R;US)
Washington Univ., Seattle (USA). Inst. for Nuclear Theory
Dynamics of six-quark systems in the soliton bag model, 11:12361 (R;US)
Soliton Bag Model, 11:12225 (R;US)
Stellar weak interaction rates: the issue of quenching, 11:12360 (R;US)
Washington Univ., Seattle (USA). Nuclear Physics Lab.
Anomalously broad spin distributions in sub-barrier fusion reactions, 11:12351 (R;US)
Superconducting tests of beta = 0.1 and beta = 0.2 resonators, 11:11802 (R;US)
WEMCO, Sacramento, CA (USA)
Froth flotation for fine-coal cleaning. Final report, 11:10860 (R;US)
Western Research Inst., Laramie, WY (USA)
Extraction of Green River and Chattanooga oil shales with strong bases and nucleophilic displacement reagents, 11:10967 (R;US)
Westinghouse Electric Corp., Carlsbad, NM (USA)
Ecosystem studies at the Los Medanos site, Eddy County, New Mexico. Volume II, 11:11043 (R;US)
Radiological consequences of brine release by human intrusion into WIPP, 11:11923 (R;US)
Stress control technique: its history and suitability for WIPP, 11:11041 (R;US)
Westinghouse Electric Corp., Madison, PA (USA)
Key points on proliferation and the LMFBR, 11:11260 (R;US)
Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.
Commercial Nuclear Waste Research and Development Program. Annual report, fiscal year 1985, 11:10989 (R;US)
Westinghouse Electric Corp., Pittsburgh, PA (USA)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 1, 11:11072 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 4, 11:11075 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 5, 11:11076 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 2, 11:11073 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 3, 11:11074 (R;US)
Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Technology Div.
Ceramic filter elements for high-pressure, high-temperature gases, 11:11222 (R;US)
West Virginia Univ., Morgantown (USA)
Carcinogenic potential of products produced by coal conversion processes. Final technical report, 11:11966 (R;US)
West Virginia Univ., Morgantown (USA). Dept. of Physics
Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
Winter (Steven) Associates, Inc., New York (USA)
Affordable manufactured housing through energy conservation. A guide to designing and constructing energy efficient manufactured homes, 11:11443 (R;US)
Wisconsin Univ., Madison (USA). Dept. of Chemistry
Photoluminescent response of palladium-cadmium sulfide and palladium-graded cadmium sulfoselenide Schottky diodes to molecular hydrogen. Technical report, 11:11571 (R;US)
Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering
Effects of irradiation and high heat flux on the lifetime performance of ferritic and 316 stainless steels, 11:11530 (R;US)
Effects of radiation and high heat flux on the performance of first-wall components. Final report, 11:12491 (R;US)
Fusion reactor physics and technology studies. Final report, October 1, 1977-November 30, 1985, 11:12493 (R;US)
Wisconsin Univ., Madison (USA). Fusion Technology Inst.
Review of failure criteria for thin wall structures in a high heat flux environment, 11:12508 (R;US)
Wright State Univ., Dayton, OH (USA)
Hardness of ion implanted ceramics, 11:11556 (R;US)
Wyoming Univ., Laramie (USA). Dept. of Chemical Engineering
Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985, 11:10785 (R;US)

Y

Yale Univ., New Haven, CT (USA)
Droplet size and evaporation rate within a two-phase flow by morphology-dependent resonances in the optical spectra. Final report, 15 November 1981-31 December 1984, 11:11732 (R;US)
Simultaneous multipoint measurements of density gradients and temperature in a flame. Final report, July 1, 1981-July 31, 1985, 11:12128 (R;US)
York Univ., Downsview, Ontario (Canada). Dept. of Chemistry
Relationships between electronic spectroscopy and electrochemistry. A probe of reorganisation energies. Technical report, 11:11638 (R;CA)

Z

Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)
Proceedings of the third meeting on nuclear analysis, 11:11623 (R;DD;In English, German and Russian)
Safety assessment of underground nuclear waste repositories using the method of status vectors, 11:11035 (R;DD;In German)

PERSONAL AUTHOR INDEX

Authors' surnames are indexed in the form appearing in the abstracted publication; given names are reduced to initials. Each author entry gives the publication title and the citation number. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes. For publications with multiple authors, an entry is provided for each author. Entries for the second and succeeding authors give references to the first author.

Because of problems involved in the mechanical preparation of this index, all accent marks are omitted. Changes in spelling introduced as a result of accent omission follow standard conventions.

A

Abashidze, L.I., Emission of light fragments ^{3}H, ^{3}He and ^{4}He in ^{4}He-nucleus collisions at 3.33 GeV/N kinetic energy, 11:12369 (R;SU)

Abassin, J.J., *See* Roth, E., 11:12474

Abe, M., Ion-exchange selectivities on antimonic acids and metal antimonates, 11:11648 (RA;XA)

Abegglen, F., K500 RF power supply, 11:11799 (RA;US)

Abelin, H., Final report of the migration in a single fracture - experimental results and evaluation, 11:11903 (R;SE)

Abillon, J.M., Solar water heater for tropical countries, 11:11184 (RA;PR)

Aboustit, B.L., *See* Advani, S.H., 11:10773

Abraham, B. M., Method and apparatus for measuring shear modulus and viscosity of a monomolecular film, 11:11766 (P;US)

Abraham, B.J., Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic). Mummichog and striped killifish, 11:11911 (R;US)

Abrefah, J., *See* Balooch, M., 11:11662

Abriola, L.M., Multiphase approach to the modeling of porous media contamination by organic compounds. I. Equation development, 11:11897 (J;US)

Acharya, R., Low-energy theorems from scale currents, 11:12261 (J;US)

Ache, H.J., *See* Ali, S.A., 11:11022

Ackerman, J.P., *See* Krumpelt, M., 11:11408

Acquadro, J.C., *See* Carlin Filho, N., 11:12299

Adam, M.J., Fluorination of aromatic compounds with F_2 and acetyl hypofluorite. Synthesis of ^{18}F-aryl fluorides by cleavage of aryl-tin bonds, 11:11724 (R;CA)

Survey of the cleavage of aryl-metal bonds by elemental fluorine. Synthesis of aryl-fluorides, 11:11723 (R;CA)

Adams, M.R., Energy perspectives - 1984, 11:11379 (RA;US)

Adee, R.R., *See* Allen, C.C., 11:11030

Adler, D., *See* Haggerty, J.S., 11:11168

Adler, L., Investigations of ultrasonic wave interactions at boundaries separating anisotropic materials. Progress report, 11:11768 (R;US)

Advani, S.H., Overview of hygrothermomechanical response modeling associated with underground coal conversion, 11:10773 (RA;US)

Agarwal, V.B., Price controls, price dispersion, and the supply of refined petroleum products, 11:10936 (J;GB)

Aggarwal, S., Multiple ignition, combustion, and quenching of hydrocarbon fuel sprays. Annual report, July 1983-July 1984, 11:11729 (R;US)

Agnew, S.F., *See* Jones, L.H., 11:11655

Agrawal, M.L., Effects of molecular organization on photophysical behavior: lifetime and steady-state fluorescence of chlorophyll a singlets in monolayers of dioleoylphosphatidylcholine at the nitrogen-water interface, 11:11687 (J;US)

Aguer, P., *See* Chemin, J.F., 11:12317

Ahmad, M., Transition probabilities in superfluid He4, 11:12129 (R;IT)

Aichelin, J., Subthreshold kaon production as a probe of the nuclear equation of state, 11:12375 (J;US)

Aid, S., *See* Steinberg, P., 11:12148

Akasofu, S., *See* Tsurutani, B.T., 11:12058

Akers, D.W., *See* Proctor, A.E., 11:11108

Akhundov, A.A., Exact calculations of the lowest-order electromagnetic corrections for the processes $e^+e^- \rightarrow \mu^+\mu^-(\text{tau}^+\text{tau}^-)$, 11:12203 (R;SU)

Albersheim, P., Why study the structures of biological molecules? The importance of studying the structures of complex carbohydrates, 11:11951 (RA;US)

See Davis, K.R., 11:11937

See York, W.S., 11:11945

Alberti, G., Fundamental properties of acid salts of tetravalent metals and some considerations on the perspectives of their application in nuclear technology, 11:11646 (RA;XA)

Albeverio, S., Trapping in stochastic mechanics and applications to covers of clouds and radiation belts, 11:12055 (R;FR)

Albrecht, G.F., An active mode-locked Q-switched oscillator using Nd^{3+} doped glass as the active medium, 11:11761 (J;US)

Albrow, M.G., *See* Kesson, T., 11:12167

Aleixo, A.N.F., Role of peripheral partial waves in the anomalous large angle scattering of n-α nuclei, 11:12366 (R;BR)

See Hussein, M.S., 11:12315

Alerhand, O.L., Dipole activity of surface phonons on Si(111)2 x 1, 11:11591 (J;US)

Alexander, A.G., Energy cane alternative, 11:11160 (RA;PR)

Energy-integrated farm plan for Puerto Rico, 11:11128 (RA;PR)

Alexander, C., Solar breeder to explain constant luminosity and the lack of neutrinos, 11:12051 (J;US)

Alexander, D.H., *See* Apted, M.J., 11:11066

Alexiades, V., *See* Solomon, A.D., 11:11765

Ali, S.A., Separation and purification of fission products from process streams of irradiated nuclear fuel, 11:11022 (RA;XA)

Allan, D.C., *See* Alerhand, O.L., 11:11591

Allard, J.P., *See* Poitou, J., 11:12342

Allen, A.S., Full-scale continuous fermentation for the commercial production of fuel ethanol, 11:11137 (RA;PR)

Allen, C.C., Hydrothermal studies of simulated defense waste glass plus basalt, 11:11030 (R;US)

Allen, G.H., Charge-transfer luminescence from mixed-ligand, 2,2',2"-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)

Framework for oil-spill response on the Alaskan OCS (Outer Continental Shelf), 11:10940 (R;US)

Allen, J.W., Atomization of coal water mixtures, 11:10865 (RA;US)

Allen, M.E., *See* Stephens, R.W., 11:10954

Allen, R.C., First observation and cross-section measurement of ν/sub e/ +e$^-$ $\rightarrow$ ν/sub e/ +e$^-$, 11:12168 (J;US)

Allen, S.L., *See* Watkins, J.G., 11:12501

Allison, S.W., *See* Gillies, G.T., 11:11775

Almehed, S., *See* Kesson, T., 11:12167

Almeida, F.I.A. de, Deformation effects in the heavy ion quarter-point angle, 11:12367 (R;BR)

Alsmiller, R.G. Jr., *See* Santoro, R.T., 11:12498

Alton, G.D., *See* Miller, P.D., 11:12118

Altseimer, J.H., Potential application of fuel cells in the chlor-alkali industry, 11:11410 (R;US)

Amaral, L.Q. do, Transitions in a lyomesophase: a study by thermal analysis and electron microscopy, 11:11581 (R;BR)
Amer, N.M., *See* Fournier, D., 11:11590
Amsbaugh, J.F., *See* Storm, D.W., 11:11802
An, Z.G., *See* Sydora, R.D., 11:12437
Anand, S., Issues in the appraisal of energy projects for oil-importing developing countries. World Bank staff working paper, 11:11377 (R;US)
Andersen, L.H., *See* Datz, S., 11:12107
Andersen, R.A., *See* Boncella, J.M., 11:11663
Anderson, C.R., Vortex method for flows with slight density variations, 11:12134 (J;US)
Anderson, E., Development of statistical distributions or ranges of standard factors used in exposure assessments. Final report, 11:12026 (R;US)
Anderson, G., Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico). Grass shrimp, 11:11910 (R;US)
Anderson, J.L., *See* Bartlit, J.R., 11:12495
Anderson, J.M., *See* Altseimer, J.H., 11:11410
Anderson, M.P., Grain growth in three dimensions: a lattice model, 11:11546 (J;US)
Andersson, P., Activation measurements of neutron-capture cross sections in the MeV region, 11:11616 (R;SE)
Neutron-capture cross-section measurements for ^{115}In and ^{197}Au in the energy region 2.0-7.7 MeV, using the activation technique, 11:12331 (R;SE)
Andrasi, A., Some experiences in incidental internal contamination monitoring and dose assessment, 11:11994 (RA;AT)
Andrese, M., *See* Robinson, D.G., 11:11930
Andres, J.N., *See* Eaztergalyos, J., 11:11224
Andrews, J.W., Thermal distribution and utilization: an interim progress report, 11:11412 (R;US)
Andrews, M.C., L-shell X-ray production cross sections in Nd, Gd, Ho, Yb, Au and Pb for 25-MeV carbon and 32-MeV oxygen ions, 11:12110 (J;NL)
M-shell electron capture and direct ionization of gold by 25-MeV carbon and 32-MeV oxygen ions, 11:12111 (J;NL)
Andriamonje, S., Production of projectile and target K X-rays by single and multiple electron capture in collisions of Si^{14+} and Si^{13+} ions with argon atoms at 4.5 and 5.5 MeV/amu, 11:12064 (R;FR)
See Chemin, J.F., 11:12317
Ang, P.G.P., *See* Sammells, A.F., 11:11848
Angelberger, P., *See* Dudczak, R., 11:11972
Angelini, M.P., *See* White, C.W., 11:11563
Annand, J.R.M., Low-energy optical-model analysis of ^{208}Pb and ^{209}Bi, 11:12345 (J;NL)
Anscrmet, J., *See* Wang, P., 11:11534
Antal, M.J., Biomass pyrolysis: a review of the literature. Part 1--carbohydrate pyrolysis, 11:11173 (BA;US)
Antillon, A., Particle dynamics for motion in a non-planar accelerator, 11:11789 (R;US)
Antonini, G., New way to handle pulverized coal: the pumpable coal/water/air mixtures (C-WAM), 11:10826 (RA;US)
Apel, H., Energy savings and building technology, 11:11438 (RA;DE;In German)
Appel, J.A., *See* Bhadra, S., 11:12165
Appleton, B.R., *See* White, C.W., 11:11563
Apsimon, R.J., Design of the optical components and gas control systems of the CERN Omega Ring Imaging Cerenkov Detector, 11:11837 (R;GB)
Apted, M.J., Conceptual model for repository source-term evaluation, 11:11066 (RA;US)
Arakawa, E.T., *See* Vo-Dinh, T., 11:11608
Aratyn, H., 2-dimensional N=2 Wess-Zumino model on the lattice; from Dirac-Kaehler formalism to the Nicolai mapping, 11:12232 (R;BR)
Superspace in the Dirac-Kaehler framework in two dimensions, 11:12233 (R;BR)
Araujo, M.M. de, Estimation of the measurement effective point in cylindrical ionization chamber used in electron beams with energies between 6 and 20 MeV, 11:11846 (R;BR;In Portuguese)
Archibald, J.F., Membrane barriers for radon gas flow restrictions, 11:10976 (R;CA)
Arora, B.R., Retrofit considerations for adding coal-water-mixture fuel capability at Houston Lighting and Power's Sam Bertron Plant, 11:10894 (RA;US)
Arruda Neto, J.D.T., Non-electric-dipole photofission of ^{235}U, 11:12352 (R;BR)
Observation of M1 strength in the photofission of actinide nuclei, 11:12353 (R;BR)
Photonuclear physics at intermediate energies, 11:12365 (R;BR;In Portuguese)
Arscott, H.C., *See* Stephens, R.W., 11:10954
Arseneau, D.J., Muonium formation in vapors, 11:12091 (R;CA)
Arthur, E.D., Applied Nuclear Science Research and Development progress report, June 1, 1984-May 31, 1985, 11:12280 (R;US)
Asami, T., *See* Murata, T., 11:12279
Asaro, R.J., Crystal plasticity analysis of large-strain shear, 11:11529 (R;US)
Asbury, J.G., Role of electric vehicles in the nation's energy future, 11:11493 (R;US)
Ashworth, R.A., Coal-sludge mixtures - a sensible coal slurry fuel, 11:10831 (RA;US)
Assanis, D.N., Computer simulation of the turbo-charged turbocompounded diesel engine system: a description of the thermodynamic and heat transfer models, 11:11487 (R;US)
Aston, T.R.C., Coal strength parameters derived for the No. 1 (Scott Pitt) seam, Drummond mine, Westville, NS, 11:10800 (R;CA)
Strata control investigations in the Sydney coalfield - Annual report, January 1 to December 31, 1984, 11:10819 (R;CA)
Atalla, R.H., Polymorphy in native cellulose: recent developments, 11:11968 (RA;US)
Atkinson, L.P., *See* Blanton, J.O., 11:11913
Atteridge, D.G., *See* Bruemmer, S.M., 11:11526
Audit, G., *See* D'Hose, N., 11:12285
See Ghedira, M.L., 11:12294
Augerat, J., *See* Poitou, J., 11:12342
Auld, E.G., *See* McParland, B.J., 11:12304
See Ziegler, W., 11:12305
Aulisio, C., *See* McGowin, C.R., 11:10901
Auria, J.M.D., *See* Ravn, H.L., 11:12065
Avasthi, J.M., Subsidence modeling of Rawlins underground coal gasification Tests 1 and 2, 11:10772 (RA;US)
Avogadro, A., Laboratory simulation of radionuclide geological migration, 11:11068 (RA;US)
Ayers, A.L. Jr., *See* Henscheid, J.W., 11:11015
Ayoub, M.M., Biomechanical and work physiology study in underground mining, excluding low coal. Open file report, 25 January 1980-22 July 1984, 11:12027 (R;US)
Azarm, M.A., Impact of mechanical- and maintenance-induced failures of main reactor coolant pump seals on plant safety, 11:11336 (R;US)
Azevedo, L.J., *See* Kwak, J.F., 11:11595
Azimov, R.I., *See* Pervushin, V.N., 11:12250

B

Babelot, J.F., *See* Ohse, R.W., 11:11538
Babic, P., Computer-aided reliability analysis of complex systems, 11:11253 (RA;CS;In Czech)
Baca, B.K., Experimental study of the performance of clustered parachutes in a low-speed wind tunnel, 11:11741 (R;US)
Bacelar, J.C., *See* Tjom, P.O., 11:12339
Bach, H., Quantifiability of energy savings, 11:11430 (RA;DE;In German)
Badalyan, A.M., Existence of ^{4}H resonances, 11:12286 (R;SU)
Bady, N., *See* Cance, M., 11:11080
Baer, D.R., Technique for comparing AES signals from different spectrometers using common materials, 11:11621 (R;US)
Baer, F., Design and analysis of Cross-Appalachian Tracer Experiment (CAPTEX) field trials. Second annual progress report, 11:11857 (R;US)
Baer, H.W., Proceedings of the LAMPF workshop on pion double charge exchange, 11:12281 (R;US)
Bahrke, W.H., *See* Humphrey, A.E., 11:10746
Bahurmuz, A.A., Multi-scattering-Xα method for analysis of the electronic structure of atomic clusters, 11:12063 (R;CA)
Bailey, M.G., *See* Shoesmith, D.W., 11:11722
Bailey, R.T., *See* Winters, P.J., 11:10867

Baity, F.W., ICRF antenna and feedthrough development at ORNL, 11:12428 (R;US)
Bajer, G.Yu., *See* Novgorodov, A.F., 11:11720
Baker, G., *See* Willson, W.G., 11:10740
Baker, J.D., *See* Gupta, V.P., 11:12329
Baker, J.R., *See* Haynes, H.W. Jr., 11:10785
Baker, N.J., *See* Baltay, C., 11:12166
Baktash, C., *See* Fewell, M.P., 11:12120
Bala, S.R., *See* Gibb, M., 11:11521
Balashazy, J., *See* Hofmann, W., 11:11993
Balassa, J.J., *See* Schroeder, H.A., 11:12012
Balaz, P., Leak-proofness of sealed spaces - important aspect of reliable operation of nuclear power plants, 11:11249 (RA;CS;In Slovak)
Balcazar, R., *See* Carreon, A.F., 11:11969
Balcomb, J.D., Passive solar heating research, 11:11196 (BA;US)
Baldewicz, W.L., *See* McKone, T.E., 11:11356
Baldo, P., *See* Seshan, K., 11:11540
Ball, F.M., *See* Mazour, T.J., 11:11391
Balooch, M., Time-resolved Auger electron spectroscopy combined with modulated molecular beam techniques for gas-surface reaction kinetics studies, 11:11662 (J;NL)
Baltay, C., Limits on like-sign dilepton production in ν/sub μ/ interactions, 11:12166 (J;US)
Baltz, A.J., *See* Hussein, M.S., 11:12364
Bamberger, C.E., Substantial solid solutions of bismuth-containing lanthanide dititanates, Ln/sub 2-x/Bi/sub x/Ti_2O_7, 11:11564 (J;US)
Synthesis and characterization of crystalline phosphate of thorium, uranium and neptunium, 11:11725 (J;CH)
See Brynestad, J., 11:11565, 11:11658
Bandong, B., Ion-excited K X-ray spectra of oxygen, 11:12076 (RA;US)
Systematics of K X-ray satellite structure excited by heavy-ion impact, 11:12075 (RA;US)
See Palinkas, J., 11:12072
Bar, J., Decontamination of nuclear power plant equipment, 11:11718 (RA;CS;In Czech)
Decontamination of nuclear power plant equipment with chlorinated hydrocarbon-based solutions and emulsions, 11:11719 (RA;CS;In Czech)
Barstov, A.N., Basis for safety standards aimed at averting fire and explosion hazards during work involving hydrogen, 11:11739 (RA;XA)
Barbara, T.M., Composite sequences for efficient double-quantum excitation over a range of spin coupling strengths, 11:12124 (J;GB)
Barber, D., *See* Skuja, A., 11:11808
Barbieri, J.F., Contour-to-grid methods for the ARAC system, 11:11886 (R;US)
Barcelo, H., Solar air conditioning, 11:11180 (RA;PR)
Barcelos Neto, J., *See* Smith, A.W., 11:12218
Barclay, R. Jr., Two-stage liquefaction catalyst evaluation. Final report, 11:10789 (R;US)
Bardadin-Otwinowska, M., Direct photon production from pions and protons at 200 GeV/c, 11:12295 (R;CH)
Bardin, D.Yu., *See* Akhundov, A.A., 11:12203
Baria, D.N., *See* Paulson, L.E., 11:10853
Bark, R.A., *See* Drumm, P.V., 11:12311
See Fifield, L.K., 11:12310
Barkley, P.G., Surface-suppressed electron resonance spectroscopies, 11:11650 (J;US)
Barlow, C.R., Renovation of DOT specification 21PF-1 protective shipping packages, 11:11746 (R;US)
Barnes, J.M., *See* Santoro, R.T., 11:12498
Barnes, S.M., *See* Westsik, J.H. Jr., 11:11028
Barnouin, O., *See* Jaanimagi, P.A., 11:12490
Barnthouse, L.W., *See* Jones, T.D., 11:10922
Barone, S.P., Economic evaluation of methanol and SNG production using UCG, 11:10755 (RA;US)
See Hill, V.L., 11:10757
Barrett, F.H. Jr., *See* Kvandal, S.C., 11:11481
Barrus, D.M., *See* Nelson, R.O., 11:12387
Bartenev, V.D., Some problems of emergency protection of helium cryostats, 11:11745 (R;SU;In Russian)
Barth, R.F., *See* Soloway, A.H., 11:11973
Bartlett, D.F., *See* Bhadra, S., 11:12165
Bartlit, J.R., Current operations and experiments at the Tritium Systems Test Assembly, 11:12495 (R;US)
Bartnicki-Garcia, S., Kingdoms with walls, 11:11950 (RA;US)
See Davis, L.L., 11:11936
Barton, D.S., Hard quark-quark scattering with exclusive reactions, 11:12170 (J;FR)
Bartsch, R.A., *See* Walkowiak, W., 11:11627
Baseia, B., Zeeman effect in highly excited atoms: 2. Three-dimensional case, 11:12093 (R;BR)
See Penaforte, J.C., 11:12410, 11:12411
Bassham, J.A., Control of photosynthetic carbon metabolism, 11:11967 (J;US)
Bastasz, R., Accelerator-based diagnostics in tandem-mirror fusion experiments, 11:12471 (J;NL)
Bates, F.S., Critical behavior of binary liquid mixtures of deuterated and protonated polymers, 11:12135 (J;US)
Batlogg, B., *See* Golding, B., 11:11536
Battist, L., *See* Mardis, M., 11:11884
See Petko, C., 11:11883
See Petko, C.M., 11:11885
Battista, R.A., Evaluation of alternate-fuels performance in an external combustion system. Final report, 11:11489 (R;US)
Battle, R.E., Emergency diesel generator operating experience, 1981-1983, 11:11235 (R;US)
Battles, J.E., Posttest analysis of beta (Na/S) cells from chloride silent power, limited. Final report, 11:11370 (R;US)
Bauer, E.R., Recognizing signs of excessive loading in underground coal mines. Information Circular/1985, 11:10925 (R;US)
Bauge, M., "CAMERA" test facility in the OSIRIS reactor. Diametral measurement device under flux of PWR fuel pins, 11:11275 (R;FR;In French)
Baughcum, S.L., Measurement of the C_2(a^{3}PI/sub u/) and C_2(X$^1\Sigma$/sub g/$^+$) disappearance rates with O_2 from 298 to 1300 kelvin, 11:11710 (J;US)
Baxter, A.M., *See* Burnett, S.M., 11:12326
Baxter, V.D., Data acquisition and testing at the Tennessee Energy Conservation in Housing (TECH) complex, 11:11442 (R;US)
Vapor-compression heat pump system field tests at the TECH complex, 11:11456 (J;US)
Baylor, L.R., Implementation and operation of VAX-based data acquisition system for the large coil task, 11:12477 (R;US)
Baynes, C.J., *See* Halton, D.M., 11:12008
Bayukov, Yu.D., Bank of data on nuclear inclusive cross-sections at high-energies of projectiles, 11:11925 (R;SU;In Russian)
Barcia Filho, D., *See* Carvalho, C.A. de, 11:12237
Beach, D.B., Transition metal-isocyanide bonding: Photoelectron spectroscopic study of iron tetracarbonyl isocyanide complexes, 11:11659 (J;US)
Beahm, D.M., Audit of the environmental qualification of safety-related electrical equipment at the Hope Creek Generating Station (Docket No. 50-354), 11:11305 (R;US)
Bean, R.M., Organohalogens in chlorinated cooling waters discharged from nuclear power stations, 11:11255 (R;US)
Beck, E.M., *See* Tjom, P.O., 11:12339
Becker, F.L., Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)
Becker, R.L., Theory of Ksup(n)Lsup(ν) multiple vacancy production by heavy ions, 11:12102 (J;NL)
Beckstead, M.W., *See* Braithwaite, P.C., 11:11781
Becraft, W.R., *See* Tsai, C.C., 11:12479
Bediaga, I., Lambda$^+$ sub(c) lifetime in a quark-diquark scheme, 11:12181 (R;BR)
Vector meson and axial-vector diquark decay constants, 11:12180 (R;BR)
Beebe, K.R., *See* Carey, W.P., 11:11629
Beeunas, M.A., *See* Knauth, L.P., 11:10998
Begun, G.M., *See* Bamberger, C.E., 11:11564, 11:11725
Bel'kov, A.A., Possibility to study electromagnetic properties of neutral pions in experiments with electron-positron colliding beams, 11:12187 (R;SU;In Russian)
Structure radiation in K $\rightarrow 2\pi\gamma$ decays, 11:12205 (R;SU;In Russian)
Belezany, E., *See* Andrasi, A., 11:11994
Belitz, K.S., *See* Corbett, B.L., 11:11290
Bell, G.J., Use of laboratory combustion tube data in monitoring and designing UCG field tests, 11:10752 (RA;US)
Bell, J.T., *See* Toth, L.M., 11:10988
Bell, M.G., *See* Wong, K.L., 11:12464
Bell, R.T., Uranium in the Circum-Ungava belt, northern Quebec and Labrador. New information form the central Labrador Trough, 11:10975 (RA;CA)

Bell, W.A., Stable isotope inventory requirements and enrichment capabilities, 11:11113 (R;US)
Bellas, G.T., *See* Fu, Y.C., 11:10886
Belli, R., *See* Michele, G.D., 11:10874
Bellissard, J., Stability and instability in quantum mechanics, 11:12399 (R;FR)
Belova, T.I., *See* Badalyan, A.M., 11:12286
Benary, O., *See* Kesson, T., 11:12167
Benedick, W.B., *See* Nelson, L.S., 11:11349
Bengtsson, H., Signatures for horizontal gauge bosons in very energetic hadronic collisions, 11:12213 (J;US)
Benjamin, A.S., Probabilistic risk assessment of filtered-vented containment systems. Mark I BWR, 11:11345 (R;US)
Bennett, A., Experience with the NRC burner assembly, 11:10881 (RA;US)
Beno, M.A., Structure of 3,4;3',4'-bis(ethylenedithio)-2,2',5,5'-tetrathiafulvalent-tetrabromoindate (2:1), (BEDT-TTF)$_2$InBr$_4$, ($C_{10}H_8S_8$)$_2$InBr$_4$, 11:11601 (J;DK)
Benson, R.D., Highlights from the assembly of the helical field coils for the Advanced Toroidal Facility, 11:12480 (R;US)
Benziger, J., *See* Schoofs, G., 11:11670
Benziger, J.B., Criteria for ignition in monopropellant engines, 11:11780 (R;US)
Berant, Z., *See* Hill, J.C., 11:12283
See Wolf, A., 11:12327
Berenyi, D., Auger electron spectra in 5.5 MeV/amu Nesup(q+) and Arsup(q+) ion impact on Ne, 11:12086 (R;SU)
Berger, E.L., Structure functions of nuclei in the pion exchange model, 11:12356 (R;US)
See Damgaard, P.H., 11:12215
Berger, M.H., Computer extended asymptotic series for the two-dimensional linear hydrodynamics of a gas centrifuge with sources and sinks, 11:10979 (R;US)
Berger, R.L., *See* Shepard, C.L., 11:11532
Bergqvist, I., *See* Andersson, P., 11:12331
Bergshoeff, E., Coupling of Yang-Mills to N=4, d=4 supergravity, 11:12229 (R;IT)
Bergstroem, U., *See* Hoffman, F.O., 11:11904
Berk, H.L., Existence and calculation of sharp boundary MHD equilibrium in three-dimensional toroidal geometry, 11:12436 (R;US)
See Kotschenreuther, M., 11:12438
Berman, B.L., Channeling-radiation measurements at Lawrence Livermore National Laboratory, 11:11597 (J;NL)
See Arruda Neto, J.D.T., 11:12352, 11:12353
Berman, M., Evaluation of the bases for estimating alpha-mode failure probabilities, 11:11350 (R;US)
See Marshall, B.W. Jr., 11:11351
Berman, S., Energy and lighting, 11:11453 (J;US)
Bernard, C., Lattice calculation of weak matrix elements, 11:12212 (J;US)
Berry, G.F., Modeling coal-water-mixture spray collective combustion, 11:10876 (RA;US)
Berry, J.M., *See* Adam, M.J., 11:11723
Berry, S.D., *See* Glass, G.A., 11:12109
Berthier, E., Works on laser-matter interaction program at the Limeil-Valenton center, 11:12427 (R;FR;In French)
Bertolami Neto, O., Formation of structures in the very early universe, 11:12040 (R;BR)
Bertoncello, R., *See* Beach, D.B., 11:11659
Bertozzi, G., *See* Cadelli, N., 11:11016
Beshore, D.G., Commercial slurry fuel developments at COMCO, 11:10841 (RA;US)
Besmann, T.M., *See* Stinton, D.P., 11:11568
Bessa, P.F., *See* Aratyn, H., 11:12232
Besson, J.C., DCI operation balance during DM2,$\gamma\gamma$ - LURE - LEP vacuum - PS- vacuum experiments (September 1983-December 1984), 11:11813 (R;FR;In French)
Betancourt, J.H., *See* Iriarte, M. Jr., 11:11206
Betancourt, J.H.H., *See* Iriarte, M., 11:11205
Betancourt, S.R., Planning waste-to-energy plants in Puerto Rico, 11:11146 (RA;PR)
Betker, A., *See* Mihara, Y., 11:11820
Betournay, M., Strength and deformation properties of various rocks from the Springhill coal mine, Nova Scotia, 11:10821 (R;CA)
Study of rock behaviour for the Donkin-Morien rock/support interaction contract, 11:10822 (R;CA)
Betten, P.R., *See* Planchon, H.P., 11:11299
Betzel, C., Circular and flip-flop hydrogen bonding in β-cyclodextrin undecahydrate: neutron diffraction study, 11:11697 (J;US)
See Saenger, W., 11:11946
Beug, M.U.D., Microbeam studies, 11:11847 (RA;US)
Beyer, L.G., *See* Guntermann, K., 11:10760
Bezerra, V.B., Generalized Euler's formula from Poisson's summation formula and some applications, 11:12412 (R;BR)
Influence of cusps and intersections on the calculation of the Wilson loop in ν-dimensional space, 11:12257 (R;BR)
Some remarks about the classical Wilson loop for a class of gauge field copies, 11:12256 (R;BR)
Beznogikh, G.G., *See* Abashidze, L.I., 11:12369
Bhadra, S., Study of inclusive K/sub S/^{0}, A, and Lambda-bar production in diffractive γp interactions, 11:12165 (J;US)
Bharadwaj, V., *See* Allen, R.C., 11:12168
Bharadwaj, V.K., *See* Bhadra, S., 11:12165
Bhattacharyya, S., Creep-rupture behavior of iron superalloys in high-pressure hydrogen, 11:11516 (R;US)
Bianchini, G. M., Vapor spill monitoring method, 11:10966 (P;US)
Bickeboeller, M., *See* Wilets, L., 11:12225
Bidoglio, G., *See* Avogadro, A., 11:11068
Biefeld, R.M., *See* Gourley, P.L., 11:11588
See Jones, E.D., 11:11586
Biel, J., *See* Bhadra, S., 11:12165
Bigelow, T.S., Pure mode swept frequency TE_{02} measurements in 6.35 cm circular waveguide, 11:12484 (R;US)
Bila, R.V., USAWC (United States Army War College) military studies program paper. Petroleum management in support of combat forces. Student essay, 11:11374 (R;US)
Bilal, A., Memory function approach to retardation effects in the relativistic two-body problem, 11:12242 (R;FR)
Billquist, P.J., *See* Kutschera, W., 11:11726
Bingham, C.R., *See* Carter, H.K., 11:12067
Binkley, J.S., *See* Ho, P., 11:11653
Bintinger, D., *See* Bhadra, S., 11:12165
Binz, A., Optimising three building projects by means of passive solar energy: Wald (Canton Zurich), Schuepfen (Canton Berne) and Preverenges (Canton Vaud), 11:11416 (RA;CH;In German)
Bionta, R.M., IMB detector - the first 30 days, 11:11843 (J;US)
Birkmire, R.W., Stable, high-efficiency, $CuInSe_2$ - based polycrystalline thin-film tandem solar cells. Annual subcontract report, 16 March 1984-15 March 1985, 11:11164 (R;US)
Birse, M.C., *See* Wilets, L., 11:12225
Bischoff, K.B., Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)
Bishop, A.R., Elements of a dialogue between nonlinear models in condensed matter and biophysics, 11:12088 (R;US)
Bishop, D.J., *See* Golding, B., 11:11536
Bishop, R., *See* Aggarwal, S., 11:11729
Bitter, M., *See* Wong, K.L., 11:12464
Bjoerkman, J.E., Low-energy predictions of a two-loop finite supersymmetric SU_5 theory, 11:12265 (J;NL)
Bjornstad, D.J., Biomass fuel use in agriculture under alternative fuel prices, 11:11133 (J;US)
Black, S.R., Basic data report: borehole WIPP-12 deepening. Waste Isolation Pilot Plant (WIPP) Project, southeastern New Mexico, 11:11044 (R;US)
Blackman, J.A., Prediction of high-energy spin-wave excitation in iron, 11:11533 (J;US)
Blair, E.T., *See* Baylor, L.R., 11:12477
Blais, N.C., Effect of bending potential on calculated product-state distributions for the reaction H + D_2 yields HD + D, 11:12059 (R;US)
Blanchard, P., Estimates of quantum deviations from classical mechanics using large deviation results, 11:12400 (R;FR)
See Albeverio, S., 11:12055
Blank, V., Irreducible *-representations of Lie superalgebras B(O,n) with finite-degenerated vacuum. Results for B(O,1), 11:12248 (R;SU)
Blanton, J.O., Multidisciplinary oceanography program on the southeastern US continental shelf, 11:11913 (J;US)
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, 1 December 1984-30 November 1985, 11:11859 (R;US)
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, 1 Dec

1984-30 November 1985, 11:11905 (R;US)
See Menzel, D.W., 11:12034
Blewitt, G., *See* Bionta, R.M., 11:11843
Blink, J.A., FORIG: a computer code for calculating radionuclide generation and depletion in fusion and fission reactors. User's manual, 11:12506 (R;US)
Blinov, M.V., Prompt neutron energy spectrum for the spontaneous fission of Cf-252, 11:12354 (R;XA)
See Kozulin, Eh.M., 11:12338
Bliss, C., Introducing indigenous coal-water-mix fuels to the Philippines: assessment of project feasibility, 11:10892 (RA;US)
Bloch, A., *See* D'Hose, N., 11:12285
Block, D.L., State of solar energy technology, 11:11404 (RA;PR)
Block, R.C., *See* Maguire, H.T., 11:12355
Blodgett, D.E., *See* Bhadra, S., 11:12165
Bloh, H. v., *See* Kaupp, A., 11:11211
Bloom, E.D., Physics with the crystal ball detector, 11:11841 (J;US)
Blumhardt, R., Evaporators, expansion chambers and defrosting processes for industrial refrigerators, 11:11427 (RA;DE;In German)
Boal, D.H., Nuclear liquid-gas phase transition, 11:12374 (R;CA)
Boatner, L.A., *See* Dubus, M., 11:11562
Boccara, C., *See* Fournier, D., 11:11590
Boccio, J.L., *See* Azarm, M.A., 11:11336
Bockris, J.O'M., *See* Later, D.W., 11:11122
Bodine, F., *See* Boercker, F., 11:11393
Bodnarczuk, M., Operational approach to high energy physics detectors at Fermilab, 11:12155 (R;US)
Boegly, W.J. Jr., Characterization plan for Solid Waste Storage Area 6, 11:11027 (R;US)
Boehm, P., *See* Steimle, F., 11:11382
Boehnlein, D., *See* Chung, S.U., 11:12140
Boercker, F., Identification of state-level energy data available from the Energy Information Administration, Private Sector Sources, and State Offices, 11:11393 (R;US)
Boettcher, C., Structure of the plant and results of measurement of energy requirement for the supply of heat and cold to the administration building at Thyssengas in Duisburg, 11:11436 (RA;DE;In German)
Boggild, H., *See* Kesson, T., 11:12167
Bojovic, T., *See* Dobrilovic, L., 11:11828
Bolander, M.A., RELAP5 thermal-hydraulic analyses of two pressurized thermal shock sequences for the Oconee-1 pressurized water reactor, 11:11311 (R;US)
Bollag, J.M., Anaerobic biogeochemical processes in the subsurface. Subsurface transport program, interactive seminar series, 11:11894 (R;US)
Bolton, R.D., *See* Hogan, G.E., 11:12169
Boncella, J.M., Preparation of $Yb[N(SiMe_3)_2]_3[AiMe_3]_3$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
Bonch-Osmolovskaya, N.A., Nonrotational states in ^{168}Er, 11:12336 (R;SU;In Russian)
Bond, V.P., Scientific Committee 71 on radiation exposure and potentially-related injury, 11:12004 (BA;US)
Bondarchenko, E.A., *See* Efremov, A.V., 11:12370
Bongiorno, S.J., *See* Edelman, R.A., 11:10813
Bonjour, E., Calorimetric investigation of the Y-Er magnetic phase diagram, 11:11505 (R;FR)
Bonner, B.E., Polarization observables Dsub(NN), P and A for $p(pol)p \rightarrow p(pol)\pi^+ n$ at 800 MeV, 11:12171 (BA;NL)
Bonugli, R.J., *See* Mirin, A.A., 11:12463
Bonzon, L.L., Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)
Boo, B.H., *See* Gaspar, P.P., 11:11709
Booth, T.E., Monte Carlo sampling of Compton scatter off moving electrons, 11:12122 (J;US)
Borcha, K., *See* Kozulin, Eh.M., 11:12338
Borden, M., Evaluation of anthracite coal water slurries, 11:10861 (RA;US)
Borge, M.J.G., *See* Ravn, H.L., 11:12065
Borges, O.N., Uranium isotope separation by magnetic field gradient and visible light acting in a liquid medium, 11:10980 (TG;US)
Borisov, A.A., Detonation characteristics of hydrogenous mixtures, 11:11736 (RA;XA)
Borst, W.L., Laser induced coal fluorescence. Twelfth quarterly technical progress report, July 1-September 31, 1985, 11:10798 (R;US)
Bosca, G., *See* Berthier, E., 11:12427
Bossert, J.E., Associations between summer circulation anomalies and sea surface temperature forcing, 11:11863 (R;US)
Bostick, W.D., Sampling, characterization, and remote sensing of aerosols formed in the atmospheric hydrolysis of uranium hexafluoride, 11:11070 (J;US)
Boswell, J., *See* Minehart, R.C., 11:12293
Botner, O., *See* Kesson, T., 11:12167
Bottcher, C., Time dependent Hartree-Fock theory of ion-atom collisions: Application to F^{9+} + Ne, 11:12103 (J;NL)
See Datz, S., 11:12107
Botter, F., *See* Roth, E., 11:12474
Boucher, D.J., *See* Schultz, M., 11:12053
Boulware, D.G., String-generated gravity models, 11:12046 (J;US)
Bounds, J.A., *See* Carter, H.K., 11:12067
Bourges, J., *See* Madic, C., 11:11115, 11:11607, 11:11613
Bowers, R.L., Astrophysics. Volume 1. Stars, 11:12049 (B;US)
Actrophysics. Volume 2. Interstellar matter and galaxies, 11:12050 (B;US)
Bowman, B.R., Concept of underground nuclear power plant siting for retaining post accident atmospheres, 11:11354 (R;US)
Bowman, J.D., *See* Hogan, G.E., 11:12169
Boyd, D.A., *See* Kleva, R.G., 11:12462
Boyd, J.K., Injector modeling and achievement/maintenance of high brightness, 11:12504 (R;US)
Boykov, G.S., *See* Blinov, M.V., 11:12354
Bozoki, G.E., *See* Cho, N.Z., 11:11294
Bracken, B.D., *See* Betancourt, S.R., 11:11146
Brackenbush, L.W., *See* Reece, W.D., 11:11998
Bracker, S.B., *See* Bhadra, S., 11:12165
Bradley, D.J., Spent fuel performance in geologic repository environments, 11:11029 (R;US)
Braithwaite, J.W., Potential effect of water influx on the dissolution rate of UO_2 in spent fuel at the Yucca Mountain, Nevada site, 11:11559 (R;US)
Source-term considerations for a potential radioactive-waste repository located in unsaturated tuff, 11:11064 (RA;US)
Braithwaite, P.C., Measurements of distributed combustion. Annual report, March 1983-June 1984, 11:11781 (R;US)
Brammer, D., *See* Boettcher, C., 11:11436
Bratton, C.B., *See* Bionta, R.M., 11:11843
Braun, C.L., Electric field assisted dissociation of charge transfer states as a mechanism of photocarrier production, 11:11708 (J;US)
Brede, O., *See* Schmidt, J., 11:11713, 11:11714
Bregman, M., *See* Baltay, C., 11:12166
Breidenbach, R.W., *See* Saxton, M.J., 11:11944
Breinig, M., *See* Glass, G.A., 11:12109
Brenchley, D.L., *See* Easterling, J.C., 11:11144
Bretz, M., Comment on "High-resolution scanning-ion-microprobe study of graphite and its intercalation compounds", 11:11592 (J;US)
Breuker, H., *See* Kesson, T., 11:12167
Bridwell, L.B., *See* Miller, P.D., 11:12118
Briec, M., *See* Roth, E., 11:12474
Briggs, J.B., *See* Schnitzler, B.G., 11:11241
Briggs, R.S., *See* Crawley, D.B., 11:11449
Bright, R.W., Sterilization of human bone by irradiation. Final report, 11:11991 (R;US)
Brimhall, J.L., Amorphous phase transition in irradiated NiTi alloy, 11:11539 (J;GB)
Brittain, R.D., *See* Wood, B.J., 11:10741
Britten, J.A., Theoretical and experimental studies of reverse combustion, 11:10763 (RA;US)
Brodsky, M.B., *See* Felcher, G.P., 11:11508
Brody, H., *See* Kesson, T., 11:12167
Bronson, J.D., Computer aided design, 11:11801 (RA;US)
Computer systems, 11:11796 (RA;US)
Bronstein, J., *See* Bhadra, S., 11:12165
Brook, I., Recovery of aerobic and anaerobic bacteria from irradiated mice, 11:11990 (R;US)
Brooks, G.A., *See* Allen, R.C., 11:12168
Brooks, J.M., Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)
Brooks, N.H., *See* Seraydarian, R.P., 11:12459
Brossard, P., Process for the recovery of americium from analytical wastes, 11:11605 (R;FR)
Brower, D.L., Observation of large amplitude, narrow-band density fluctuations in the interior region of

an Ohmic tokamak plasma, 11:12465 (J;US)
Brown, D.J., Geology underlying 200-area tank farms, 11:12029 (R;US)
Brown, D.K., *See* Maskarinec, M.P., 11:11480
Brown, G.M., *See* Betzel, C., 11:11697
See Saenger, W., 11:11946
Brown, J.D., Moessbauer study of the kinetics of Fe^{3+} photoreduction on TiO_2 semiconductor powders, 11:11704 (J;US)
Brown, J.J., *See* Sun, T., 11:10779
Brown, L.L., *See* Dworkin, A.S., 11:11696
Brown, N.E., Hawaii Natural Energy Institute annual report, July 1981-June 1982, 11:11383 (R;US)
Brown, O.F. II, Developments over the last two years concerning nuclear transportation and federal preemption, 11:10992 (R;US)
Insurance-indemnity coverage for nuclear transportation: an overview, 11:11083 (R;US)
Brown, R.E., Polarization in three-nucleon breakup: Experiment and theory, 11:12289 (J;NL)
See Jarmie, N., 11:12290
Brown, T.D., *See* Fu, Y.C., 11:10886
Brown, T.G., Configuration and structural design of Compact Ignition Tokamak, 11:12482 (R;US)
Browne, N., *See* Anderson, E., 11:12026
Bruandet, J.F., *See* Chemin, J.F., 11:12317
Bruce, R.J., *See* West, C.A., 11:11934
Bruckenstein, S., *See* Opekar, F., 11:11602
Bruemmer, S.M., Measurement and prediction of sensitization development in austenitic stainless steels, 11:11526 (R;US)
Bruining, J., *See* Ronde, H., 11:10754
Brumovsky, M., *See* Horacek, L., 11:11318
Brun, T.O., *See* Susman, S., 11:11367
Bruyet, B., *See* Gadelle, C., 11:10768
Bryan, W.E., *See* Baity, F.W., 11:12428
See Nelson, B.E., 11:12481
Bryant, B.J., *See* Nesnow, S., 11:11870
Bryant, W.R., *See* Brooks, J.M., 11:10958
Bryers, R.W., On-line measurements of fouling and slagging (full-scale and pilot units) and correlation with predictive indices in conventionally fired steam generators, 11:11212 (RA;US)
Brynda, J., *See* Horacek, L., 11:11318
Brynestad, J., Removal of oxide contamination from silicon carbide powders, 11:11565 (J;US)
Synthesis of submicron titanium diboride powders, 11:11658 (J;US)
Bryson, J.W., ORVIRT.PC: a 2-D finite-element fracture analysis program for a microcomputer, 11:11236 (R;US)
Buchanan, A.C. III, Smith, G.P., *See* Dworkin, A.S., 11:11696
Bucher, I.Y., CFT compiler optimization and Cray X-MP vector performance, 11:12522 (R;US)
Buckalew, W.H., *See* Bonzon, L.L., 11:11343
Buckius, R.O., *See* Krier, H., 11:10897
Budilov, V.A., *See* Abashidze, L.I., 11:12369
Bulla, W., Deficiency indices and singular boundary conditions in quantum mechanics, 11:12401 (R;FR)
Bunce, G.M., *See* Barton, D.S., 11:12170
Buon, J., Resonant depolarization in electron storage rings equipped with "siberia snakes", 11:11811 (R;FR)
Suppresion of beam-beam depolarization, 11:11812 (R;FR)
Survey of fully antisymmetric rotators for the electron rings HERA and LEP, 11:11810 (R;FR)
Burch, R., *See* Mihara, Y., 11:11820
Burdon, J.M., *See* Sexton, R., 11:11955
Buresi, E., *See* Berthier, E., 11:12427
Burford, C.L., *See* Ayoub, M.M., 11:12027
Burke, F.P., *See* Winschel, R.A., 11:10783
Burkert, V., *See* Kesson, T., 11:12167
Burkhalter, P.G., Spectroscopy of Ldagger-series transitions for x-ray laser photopumping, 11:11760 (J;US)
Burnett, D., *See* Bennett, A., 11:10881
Burnett, S.M., Octupole vibrational states in the even-mass barium isotopes, 11:12326 (R;AU)
Burns, L.K., *See* Marcouiller, B.A., 11:10751
Burrell, K.H., *See* Seraydarian, R.P., 11:12459
Burrill, K.F., *See* Bennett, A., 11:10881
Burton, W., *See* Janicki, A., 11:11909
Busch, G.E., *See* Shepard, C.L., 11:11532
Busey, R.H., *See* Simonson, J.M., 11:11660
Bush, D.M., *See* Magnani, N.J., 11:11372
Bustamante, C., *See* Patterson, C.W., 11:11948
Butcher, T., *See* Bliss, C., 11:10892
Butler, P.C., *See* Magnani, N.J., 11:11372
Butler, W., *See* Tsurutani, B.T., 11:12058
Butner, R.S., Low-temperature thermochemical conversion of high-moisture biomass feedstocks, 11:11132 (R;US)
Butterfield, M.H., *See* Russell, N.S., 11:11084
Byers, G.E., *See* Volk, B.G., 11:11896
Byers, K.R., Safeguards and security design guidelines for conceptual Monitored Retrievable Storage (MRS) facilities, 11:11085 (J;US)
Bykov, V.M., *See* Glebov, I.A., 11:11271
Byrer, C.W., *See* Cooke, S.D., 11:10809
Byrne, A.P., *See* Poletti, A.R., 11:12340, 11:12341
Bystritskij, V.M., Measurement of the pμ-atom scattering cross section in gaseous hydrogen, 11:12087 (R;SU;In Russian)

C

Cacic, C.G., *See* Legeled, M.A., 11:11097
Cadelli, N., PAGIS summary report of phase 1: a common methodological approach based on European data and models, 11:11016 (R;IT)
Cadwell, J.J., Developing a curriculum for training nuclear protective force persons in legal matters, 11:11110 (J;US)
Cain, P., Empirical methods of support design for the Sydney coalfield, 11:10820 (R;CA)
See Aston, T.R.C., 11:10819
Cairns, E.J., *See* Flatt, J.H., 11:11699
Calado, J.C.G., *See* Rubio, R.G., 11:11677
Calamai, P.H., Quasi-Newton methods with bounds, 11:12518 (R;US)
Calemczuk, R., *See* Bonjour, E., 11:11505
Callcott, T.A., *See* Vo-Dinh, T., 11:11608
Callen, B., *See* Kesson, T., 11:12167
Callen, J.D., *See* Shaing, K.C., 11:12460
Calvo, O., Initial estimate of transmission line effects in SSC Design D magnets, 11:11809 (R;US)
Camaioni, D.M., Determination of radical initiating and hydrogen donating properties of coal liquefaction process solvents by reaction with fluorenone, 11:10792 (R;US)
Campbell, J.C., *See* Landry, G., 11:10845
Campbell, J.R., *See* Luthy, R.G., 11:10738
Campbell, S.G., Chlorophyll a concentration and distribution in Twin Lakes, Colorado prior to operation of Mt. Elbert Pumped-Storage Powerplant, 1977-1981. Technical report, 11:11154 (R;US)
Campostrini, M., Quarkonia spectra from lattice gauge theories, 11:12266 (J;NL)
Can, C., *See* Palinkas, J., 11:12072
Cance, M., Measurement methods of alpha activity in nuclear wastes: gamma spectrometry, detection of fission neutrons, 11:11080 (R;FR;In French)
Canto, L.F., *See* Aleixo, A.N.F., 11:12366
See Hussein, M.S., 11:12315
Cao, A., Contribution to regularizing iterative method development for attenuation correction in gamma emission tomography, 11:11974 (R;FR;In French)
Cao, J., *See* Wang, Y.S., 11:10882
Cao, X., *See* Xie, M., 11:10889
Capes, C.E., *See* Bennett, A., 11:10881
Caporaso, G.J., Beam breakup and the conceptual design of guided and unguided accelerators, 11:11791 (R;US)
Carchon, R., *See* Strohm, W.W., 11:11107
Cardoso Junior, J.L., *See* Schelin, H.R., 11:12298
Carey, W.P., Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)
Carli, G., Coal beneficiation by expansion of a supercritical coal/water slurry, 11:10828 (RA;US)
Carlin Filho, N., Study on particle emission in the light-heavy ion fusion reactions: ^{14}N, sup(16,18) O + ^{12}C, 11:12299 (R;BR)
See Coimbra, M.M., 11:12313
See Toledo, A.S. de, 11:12314
Carlini, R., *See* Hogan, G.E., 11:12169
Carlson, B.V., Intermediate energy nucleon-nucleus total reaction cross section in the Dirac phenomenology, 11:12318 (R;BR)
Near/far decomposition of the proton-nucleus and antiproton-nucleus elastic scattering angular distributions, 11:12320 (R;BR)
Reactive content of the proton-nucleus impulse - approximation Dirac optical potential, 11:12319 (R;BR)
See Hussein, M.S., 11:12300, 11:12301, 11:12364
Carlson, C.E., *See* Tourangeau, P.C., 11:10812
Carlson, D.E., Research on high-efficiency, single-junction, monolithic, thin-film a-Si solar cells. Annual subcontract progress report, 1 February 1984-31 January 1985, 11:11165 (R;US)

Carlsson, S.A., Sundbyberg coal water fuel fired boiler - experiences gained between the 6th and 7th International Symposium on Coal Slurry Fuels, 11:10888 (RA;US)
Carlton, C.H., Progress in the design of coal-water fuel plants, 11:10836 (RA;US)
Carne, T.G., *See* Martinez, D.R., 11:11742
Carneiro, C.E.I., Asymptotic behavior of quark masses induced by instantons, 11:12184 (R;BR)
Carpenter, M.K., Photoluminescent response of palladium-cadmium sulfide and palladium-graded cadmium sulfoselenide Schottky diodes to molecular hydrogen. Technical report, 11:11571 (R;US)
Carpita, N.C., Cell wall development in maize coleoptiles, 11:11958 (RA;US)
Carreon, A.F., Endogenous acceptors for polyuronide biosynthesis in Mucor rouxii, 11:11969 (RA;US)
Carrilho, P., *See* Aleixo, A.N.F., 11:12366
See Hussein, M.S., 11:12315
Carroll, A.S., *See* Barton, D.S., 11:12170
Carter, H.K., First results from the UNISOR collinear laser facility, 11:12067 (R;US)
Carter, J.A., *See* Smith, D.H., 11:11619, 11:11721
Carter, J.G., *See* Hunter, S.R., 11:11770
Carter, R.J., *See* Laughery, K.R. Jr., 11:11266
Cartner, J.A., *See* Weiss, L.H., 11:10848
Cartwright, D.C., *See* Paixao, F.J. da, 11:12126
Caruso, F., Glueballs in $\pi^- p \rightarrow$ phi phi n, 11:12178 (R;BR)
Carvalheiro, Z., *See* Arruda Neto, J.D.T., 11:12352
Carvalho, C.A. de, Percolation temperature and the 'instability' of the effective potential, 11:12237 (R;BR)
Caskey, D.L., *See* Miyoshi, D.S., 11:11093
Caspar, J.V., Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)
Caspi, S., *See* Taylor, C.E., 11:11805
Cassidy, R.M., *See* Miller, F.C., 11:10978
Catalano, A., *See* Carlson, D.E., 11:11165
Cattani, M.S.D., Gentilion hypothesis for quark colours, 11:12239 (R;BR;In Portuguese)
Gentilionic approach to quark colours, 11:12238 (R;BR)
See Fernandes, N.C., 11:12404
Caudron, R., *See* Bonjour, E., 11:11505
Causilla, H., Design considerations for coal-water slurry handling systems at utility and industrial plants, 11:10835 (RA;US)
Cavailler, C., *See* Sauneuf, A., 11:12426
Cavanagh, R.R., Laser studies of chemical dynamics at the gas-solid interface. Progress report, 11:11511 (R;US)
Cech, J., Problems of applying the reliability theory in the nuclear power plant situation, 11:11323 (RA;CS;In Czech)
Cecil, F.E., Measurement and application of DDsub(γ), DTsub(γ) and D^3Hesub(γ) reactions at low energy, 11:12291 (J;NL)
Cen, K., *See* Wang, Z., 11:10833
See Xie, M., 11:10889
Cena, R.J., *See* Hill, R.W., 11:10744
Cernansky, N.P., Preignition oxidation characteristics of hydrocarbon fuels. Final report, 15 April 1980-14 October 1984, 11:11728 (R;US)
Ceyer, S.T., Orientation of CH_3NC adsorbed on Ag(311), 11:11680 (J;US)
Cha, Y.S., *See* Hull, J.R., 11:11183
Chaba, A.N., *See* Bezerra, V.B., 11:12412
Chaiken, R.F., *See* Soroka, K.E., 11:10776
Chaki, T.K., Overload effect and fatigue crack propagation in amorphous metallic alloys, 11:11548 (J;US)
Chamberlin, J.L., *See* Magnani, N.J., 11:11372
Chambre, P.L., *See* Pigford, T.H., 11:11059
Champion, R.L., Negative ion detachment cross sections. Progress report, March 1, 1985-February 28, 1986, 11:12068 (R;US)
Champney, P.D.., *See* Smith, I.D., 11:11856
Chan, P., *See* Levine, M.D., 11:11455
Chan, V.S., *See* Liu, C.S., 11:12466
Chance, M.S., *See* Cheng, C.Z., 11:12452
Chandelle, V., *See* Patigny, J., 11:10745
Chang, C.Y., OPAL experiment at LEP: P. Rapp progress report, 11:11807 (RA;US)
PLUTO collaboration: $e^+ e^-$ interactions at PETRA, 11:12147 (RA;US)
Chang, H.L., Sweep efficiency model for underground coal gasification, 11:10769 (RA;US)
Chang, L.K., *See* Planchon, H.P., 11:11299
Chang, R.K., Droplet size and evaporation rate within a two-phase flow by morphology-dependent resonances in the optical spectra. Final report, 15 November 1981-31 December 1984, 11:11732 (R;US)
Simultaneous multipoint measurements of density gradients and temperature in a flame. Final report, July 1, 1981-July 31, 1985, 11:12128 (R;US)
Chang, S.G., *See* Littlejohn, D., 11:11628
Chang, T.C., Multiresonant four-wave mixing spectroscopy of pentacene in naphthalene, 11:11688 (J;US)
Chang, Z.Y., *See* Shan, Z.Y., 11:12394
Chapman, E.G., *See* Smith, R.D., 11:11631
Chappelle, H.H., Analysis of the potential for enhanced oil recovery in the Shannon Formation at Naval Petroleum Reserve Number 3. Master's thesis, 11:10930 (R;US)
Charatis, G., *See* Burkhalter, P.G., 11:11760
Charboneau, B.L., Overview of TRAC-BD1/MOD1 assessment studies, 11:11337 (R;US)
Charl, M.V., *See* Gagnon, A., 11:10857
Charl, S., *See* Gaspar, P.P., 11:11709
Charlot, L.A., *See* Bruemmer, S.M., 11:11526
Charvillat, Five years experience of pulse columns extraction cycles for the reprocessing of fast breeder reactor fuels at the Marcoule pilot plant (SAP), 11:10987 (R;FR)
Chatterjee, A., *See* Wright, H.A., 11:12389
Chauvet, J.P., *See* Agrawal, M.L., 11:11687
Chauvet, Y., Vectorization and multitasking with a Monte-Carlo code for neutron transport problems, 11:12382 (R;FR)
Chauvin, R., *See* Gadelle, C., 11:10768
Chavez, P.F., *See* Dawson, P.R., 11:12035
Chekan, G.J., Design of bulkheads for controlling water in underground mines. Information Circular/1985, 11:10824 (R;US)
Chemin, J.F., Measurement of the ionization probability of the 1s sigma molecular orbital in half a collision at zero impact parameter, 11:12317 (R;FR)
See Andriamonje, S., 11:12064
Chen, C.H., *See* Hurst, G.S., 11:12172
Chen, F., *See* Xie, M., 11:10889
Chen, H.H., Proton decay and solar neutrino experiment with a liquid argon Time Projection Chamber, 11:11845 (J;US)
See Allen, R.C., 11:12168
Chen, J.A., *See* Cooper, J.B., 11:11953
Chen, K.S., *See* Advani, S.H., 11:10773
Chen, L., *See* White, R.B., 11:12449
Chen, S.M., *See* Advani, S.H., 11:10773
Chen, W.Y., Enhanced coal liquefaction with ammonia and amines in single and binary solvent systems. Seventh quarterly report, April 1-June 30, 1985, 11:10780 (R;US)
Chen Yudan, *See* Wang Yuzhu, 11:12083
Chenebault, P., *See* Roth, E., 11:12474
Cheng, C., *See* Treves, S., 11:11717
Cheng, C.Z., Low-n shear Alfven spectra in axisymmetric toroidal plasmas, 11:12452 (R;US)
Cheng, S.I., Dynamic simulation of entrained coal gasification, 11:10742 (R;US)
Cherkaoui, R., *See* Kox, S., 11:12302
Cherry, M.L., Beyond proton decay: other physics possibilities with the Homestake nucleon decay detector, 11:12174 (J;US)
Chess, E.K., *See* Smith, R.D., 11:11620
See Wright, C.W., 11:10927, 11:10928
Cheyette, O., Derivative expansion of the effective action, 11:12264 (J;US)
Chiang, T., *See* Hsieh, T.C., 11:11537
Chick, L.A., *See* McGrail, B.P., 11:11048
Chigier, N., *See* Meyer, P.L., 11:10866
Childs, P.W., *See* Courville, G.E., 11:11419
Chipman, D.M., Electron affinity of hydroxyl radical, 11:12101 (J;US)
Chisholm, G.H., *See* Lindsay, R.W., 11:11277
Chiu, H.H., *See* Berry, G.F., 11:10876
Chiu, N.W., Techniques of sample attack used in soil and mineral analysis. Phase I, 11:11614 (R;CA)
Chiu, W., *See* Musikant, S., 11:11490
Cho, N.Z., Comparison of methods applicable to evaluation of nuclear power plant technical specifications, 11:11294 (R;US)
Choi, D.I., *See* Hong, B.G., 11:12432
Choi, J.G., Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)
Choi, J.O., *See* Guntermann, K., 11:10760
Choi, U.S., *See* Berry, G.F., 11:10876
Chong, C.Y., Information structures for the control of large scale systems. Final technical report, September 1980-March 1984, 11:11210 (R;US)
Choppin, G.R., *See* Morse, J.W., 11:11727
Choudhury, S.R., Excited quarks and GIM mechanism, 11:12210 (R;AU)
Chow, O.K., *See* Hargrove, M.J., 11:10893

Christensen, R. M., *See* Kulkarni, S. V., 11:11495
Christian, J., Statistically based parametric analysis of exterior envelope thermal mass effect predictions, 11:11417 (R;US)
Christillin, P., Radiative muon capture on ^{16}O, 11:12303 (R;SU;In Russian)
Christophorou, L.G., *See* Hunter, S.R., 11:11770
Chu, B.T., *See* Chang, R.K., 11:11732, 11:12128
Chu, T., *See* Shiu, K.K., 11:11293
Chueshov, I.D., Hopf equation for an infinite-dimensional phase space dynamical system and Euclidean quantum field theory, 11:12245 (R;SU;In Russian)
Chung, S.U., Partial wave analysis of KKPI system in D and E/IOTA region, 11:12140 (R;US)
Church, D.A., *See* Palinkas, J., 11:12071
Cieslak, M.J., Precipitate formation in austenitic stainless steel welds, 11:11545 (J;US)
Cieslak, W.R., *See* Delnick, F.M., 11:11700
Ciliberti, D.F., *See* Lippert, T.E., 11:11222
Cilik, I., Requirements for designing large district heating systems with respect to operating reliability, 11:11319 (RA;CS;In Czech)
See Stanicek, J., 11:11228
Clabo D.A. Jr., Silicon analog of benzene—hexasilabenzene (Si_6H_6), 11:12100 (J;US)
Clancy, B.E., SCORCH - a zero dimensional plasma evolution and transport code for use in small and large tokamak systems, 11:12425 (R;AU)
Clancy, P., *See* Rubio, R.G., 11:11677
Clark, D.J., Positive heavy-ion sources, 11:12121 (BA;US)
Clark, G.A., *See* Haider, G., 11:10885
Clark, J.L., *See* Dombsky, M., 11:12344
Clark, R.A., Surry steam generator - examination and evaluation, 11:11256 (R;US)
Clark, R.E.H., Ionization from the sublevels nl with n = 5 and 6 in highly charged ions, 11:12125 (J;GB)
Clark, R.G., *See* Byers, K.R., 11:11085
Clark, R.P., *See* Magnani, N.J., 11:11372
Clarke, J., *See* Hilbert, C., 11:11751, 11:11752
See Martinis, J.M., 11:11750
Clarke, R., *See* Bretz, M., 11:11592
Clausen, M.J., *See* Morgenstern, M.H., 11:11327
Clearfield, A., Synthetic inorganic ion exchangers and their potential use in the nuclear fuel cycle, 11:11645 (RA;XA)
Clemons, G., *See* Cohen, R.A., 11:11949
Cleveland, B.T., *See* Davis, R. Jr., 11:11842
Close, D.A., *See* Cooley, J.N., 11:10982
Close, J.A., Aging/Systems Interaction Study, Component Residual Lifetime Evaluation and Feasibility of Relicensing. Progress report, FY 1985, 11:11233 (R;US)
Clough, R.L., *See* Bonzon, L.L., 11:11343
Coats, R.S., *See* Freeman, J.R., 11:12094
Coester, F., *See* Berger, E.L., 11:12356
Cohen, B.I., *See* Rognlien, T.D., 11:12456
Cohen, R.A., Correlation between bioassay and radioimmunoassay for erythropoietin in human serum and urine concentrates, 11:11949 (J;US)
Cohen, R.S., *See* Cernansky, N.P., 11:11728
Cohn, S.H., *See* Glaros, D., 11:11980
Coimbra, M.M., Use of energy-averaged cross sections for nuclear spectroscopy: ^{26}Mg states in the continuum, 11:12313 (R;BR)
See Carlin Filho, N., 11:12299
See Toledo, A.S. de, 11:12314
Cole, A.J., *See* Kox, S., 11:12302
Cole, D.M., *See* Cecil, F.E., 11:12291
Cole, S. W., Method and apparatus for I-V data acquisition from solar cells, 11:11172 (P;US)
Coleman, R.V., Spectroscopy of surface adsorbed molecules (scanning tunneling microscopy). Progress report, May 1, 1985-April 30, 1986, 11:12396 (R;US)
Colgate, S.A., Non-LTE astrophysics and the origin of high energy cosmic rays, 11:12052 (J;US)
Collins, J.C., Status of perturbative QCD , 11:12223 (R;US)
[Theoretical elementary particle studies.] Final report, September 1983-July 1985 , 11:12224 (R;US)
Collins, L.A., Comparison of models for the free-free Gaunt factor at low temperatures and frequencies, 11:12384 (R;US)
Coltrin, M.E., *See* Ho, P., 11:11653
Combe, P., *See* Albeverio, S., 11:12055
See Blanchard, P., 11:12400
Comella, P., *See* Schweitzer, D.G., 11:11054
Compere, A.L., Stability and composition of palm, coconut and soy oil fatty acid microemulsion diesel fuels, 11:11499 (R;US)
Conklin, J.J., *See* Gruber, D.F., 11:11989
Conn, R.W., *See* Kulcinski, G.L., 11:12493
Connelly, M., *See* Battista, R.A., 11:11489
Connolly, P.L., *See* Baltay, C., 11:12166
Cook, D.A., Coal-water-fuel firing experience at Chatham #2, 11:10890 (RA;US)
Cook, J.A., *See* Einziger, R.E., 11:11047
Cook, J.L., *See* Clancy, B.E., 11:12425
Cook, T.I., Safety Evaluation Report, Pump and Valve Inservice Testing Program, Crystal River, Unit 3 (Docket No. 50-302). Revision 1, 11:11239 (R;US)
Cooke, J.F., *See* Blackman, J.A., 11:11533
Cooke, S.D., Site characterization and environmental monitoring approach for UCG research and development in bituminous coals, 11:10809 (RA;US)
Cooley, J.N., Results from the study of UF_6 consumption on centrifuge process piping and its influence on gamma ray measurements, 11:10982 (J;US)
Coolidge, M.B., *See* Shackelford, S.A., 11:11694
Coop, K., *See* Fehlau, P.E., 11:11840
Cooper, B.R., Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
Cooper, D.W., *See* Evans, J.S., 11:11997
Cooper, J.B., Glycoprotein component of plant cell walls, 11:11953 (RA;US)
Hydroxyproline synthesis is required for cell wall regeneration, 11:11935 (RA;US)
Cooper, L.M., *See* Cooke, S.D., 11:10809
Cooper, M.D., *See* Hogan, G.E., 11:12169
Cooper, W.A., *See* Spong, D.A., 11:12443
Copenhaver, E.D., *See* Leland, H.V., 11:11917
Corbett, B.L., High Flux Isotope Reactor quarterly report, July-September 1985, 11:11290 (R;US)
Corbould, M.A., Network approach to large-scale experimental data acquisition and analysis, 11:12473 (R;AU)
Corcoran, D.T., *See* Storm, D.W., 11:11802
Corcoran, P.A., *See* Smith, I.D., 11:11856
Cork, C.P., *See* Goulding, F.S., 11:12325
Corlett, R.C., *See* Mortazavi, H.R., 11:10771
Cormier, T.M., *See* Coimbra, M.M., 11:12313
See Toledo, A.S. de, 11:12314
Corradini, M.L., Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels, 11:11348 (R;US)
Two-dimensional empirical model for analyzing steam explosion experiments, 11:11344 (R;US)
Correl, F.D., *See* Brown, R.E., 11:12289
Corrill, L.S., *See* Leland, H.V., 11:11917
Cort, G., *See* Nelson, R.O., 11:12387
Cortez, B.G., *See* Bionta, R.M., 11:11843
Costa, J.L.C., Closed homogeneous cosmological model with short range magnetic field, 11:12038 (R;BR;In Portuguese)
Cote, D., *See* Dooher, J.P., 11:10796
Cottingham, J., *See* Taylor, C.E., 11:11805
Cottingham, W.N., *See* Vinh Mau, R., 11:12158
Cottone, G., *See* Cadelli, N., 11:11016
Coulter, C.A., *See* Markin, J.T., 11:11092
Courville, G.E., Dynamic thermal performance of light weight insulated low-slope roof systems, 11:11419 (R;US)
Coutinho, F.A.B., *See* Perez, J.F., 11:12407
Coutts, T.J., *See* Naseem, S., 11:11171
Couvert, P., *See* McParland, B.J., 11:12304
Covell, J., *See* Dana, G.F., 11:10749
Covill, I.D., *See* Whaley, H., 11:10891
Cowden, T., *See* Bronson, J.D., 11:11796, 11:11801
See Haenni, D.R., 11:12069
Cowell, J., *See* Apsimon, R.J., 11:11837
Cowern, N.E.B., *See* Miller, P.D., 11:12118
Cowley, S.W.H., *See* Tsurutani, B.T., 11:12058
Cox, D.D., *See* Beno, M.A., 11:11601
Craig, D.S., Effect of the choice of scattering data, bound or unbound, and the energy group structure on the calculated absorptions in the 1 eV Pu-240 resonance, 11:12347 (R;CA)
Craig, P., *See* Levine, M.D., 11:11455
Craig, P.M., *See* Yeh, G.T., 11:11058
Crane, J.K., High-resolution absorption spectrum of the $6^1S_0 \rightarrow 6^3P_1$ transition in mercury with a Cw dye laser, 11:12092 (R;US)
Craun, J.C., *See* Gray, R.H., 11:10793

Crawford, D.W., *See* Legeled, M.A., 11:11097
Crawford, H., *See* Gould, H., 11:12116
Crawley, D.B., Envelope design implications of ASHRAE Standard 90.1P: a case study view, 11:11449 (R;US)
Crittenden, R., *See* Chung, S.U., 11:12140
Crofts, A.R., *See* Itoh, S., 11:11174
Crossley, D.A. Jr., *See* Van Hook, R.I. Jr., 11:12013
Crowe, C., *See* Evans, G.H., 11:11178
Crowell, J.E., Effect of potassium on the chemisorption of carbon monoxide on the Rh(111)crystal face, 11:11666 (J;NL)
Crozon, M., High energy physics in our society, 11:12139 (R;FR)
Cruess, D.F., *See* Stek, M., 11:11992
Crynes, B.L., *See* Seapan, M., 11:10782
Csanak, Gy., *See* Paixao, F.J. da, 11:12126
Csekey, L., *See* Balaz, P., 11:11249
Csiszar, A., *See* Hollo, E., 11:11276
Cudnik, R.A., *See* Razgaitis, R., 11:11413
Cugnon, J., *See* L'hote, D., 11:12316
Cullen, W., Review of the models and mechanisms for environmentally-assisted crack growth of pressure vessel and piping steels in PWR environments, 11:11524 (R;US)
Culley, G.E., *See* Pitner, A.L., 11:11315
Culwick, B.B., Status of the National Synchrotron Light Source upgrade, 11:11783 (R;US)
Cummings, G.E., Summary report on the Seismic Safety Margins Research Program, 11:11338 (R;US)
Cummins, R., *See* Janicki, A., 11:11909
Cunningham, M.E., *See* Lanning, D.D., 11:11237, 11:11238
Curado, E.M.F., Potts ferromagnet correlation length in hypercubic lattices: Renormalization - group approach, 11:12395 (R;BR)
Curlee, R.M., Valve monitor designs for security applications, 11:11089 (J;US)
Curlee, T.R., Forecasting world oil prices: the evolution of modeling methodologies and summary of recent projections, 11:10932 (J;US)
Curth, E.A., *See* Dalzell, R.S., 11:10823
Curtis, G.B. Jr., Industrial wood energy feasibility studies, 11:11149 (RA;PR)
Curtis, W.P., *See* Moody, C.E. Jr., 11:11392
Cusson, R.Y., Time-dependent Dirac equation with relativistic mean-field dynamics applied to heavy-ion scattering, 11:12306 (J;US)
Cutting, J.C., *See* Borden, M., 11:10861
Cybulskis, P., *See* Benjamin, A.S., 11:11345
Czako, S., *See* Hollo, E., 11:11276
Czech, B.P., *See* Walkowiak, W., 11:11627

D

D'Aiello, R.V., *See* Carlson, D.E., 11:11165
D'Ambrosia, J.T., Defense radioactive waste management activities: an overview, 11:11050 (J;US)
D'Aquanni, R.T., Community supported wind resource monitoring network, 11:11208 (RA;PR)
D'Auria, J.M., *See* Dombsky, M., 11:12344
D'Hose, N., Study of the ^{3}He(γp)np reaction in the region of the resonance Δ(1232), 11:12285 (R;FR;In French)
Dabbs, J.W.T., *See* Maguire, H.T., 11:12355
Dahl, P., *See* Taylor, C.E., 11:11805
Dahling, B.A., *See* Berman, B.L., 11:11597
Dalal, V., Research on high-efficiency, stacked, multijunction, amorphous silicon alloy thin-film solar cells. A semiannual subcontract progress report, 1 October 1984-15 May 1985, 11:11169 (R;US)
Dale, J.M., *See* Rosseel, T.M., 11:12115
Dale, M.C., Conversion of food processing wastes into ethanol using a novel biological reactor/separator. Final report, September 1, 1984-September 30, 1985, 11:11139 (R;US)
Dalverny, L.E., *See* Soroka, K.E., 11:10776
Dalzell, R.S., Remedial and stratareplacement techniques on longwall faces. Report on the state of the art. Information Circular/1985, 11:10823 (R;US)
Damgaard, P.H., Exclusive decays of heavy mesons into baryons, 11:12215 (J;NL)
Dana, G.F., Preliminary results of postburn coring and drilling at WIDCo-CRIP UCG experimental test site, Centralia, Washington, 11:10749 (RA;US)
Daniel, J.H., *See* Penland, R.K., 11:11397
Danly, B.G., Generalized nonlinear harmonic gyrotron theory, 11:11777 (J;US)
Danzmann, H., Role of experts in the safety and reliability of nuclear installations. Analysis of situation in the Federal Republic of Germany, 11:11316 (RA;CS;In German)
Darooka, D., *See* Musikant, S., 11:11490
Darriulat, P., Supersymmetry: experimental signatures at hadron colliders, 11:12143 (R;CH)
Darvill, A.G., *See* Albersheim, P., 11:11951
See Davis, K.R., 11:11937
See York, W.S., 11:11945
Das, P.K., *See* Kumar, C.V., 11:11707
See Murty, B.A.R.C., 11:11706
Daschil, F., *See* Hofmann, W., 11:11993
Datskov, V.I., *See* Bartenev, V.D., 11:11745
Datz, S., Correlated two electron effects in collisions of multiply-charged Au ions with He, 11:12107 (J;NL)
See Berman, B.L., 11:11597
Daudin, B., *See* Dubus, M., 11:11562
Daugherty, S.R., *See* Gat, U., 11:11300
Dautresme, B., Modeling and experimental studies of electrolinking, 11:10764 (RA;US)
David, P., *See* Kwinta, J., 11:11604
David, S.A., *See* Reed, R.W. Jr., 11:11747
Davidson, I., *See* Cherry, M.L., 11:12174
Davidson, R.C., Kinetic description of harmonic instabilities in a planar wiggler free-electron laser, 11:11759 (J;US)
Davidson, S.C., *See* McTernan, E.M., 11:10808
Davies, R.W., Department of Energy briefing session statement, 11:12393 (BA;US)
Davis, B.E., Critical economic parameters for underground coal gasification, 11:10916 (RA;US)
Davis, C.B., Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
Davis, E.C., *See* Yeh, G.T., 11:11058
Davis, H.F., *See* Kumar, C.V., 11:11707
Davis, H.L., *See* Noonan, J.R., 11:12123
Davis, K.R., Identification of oligogalacturonide-elicitors of phytoalexin accumulation released from sodium polypectate by an endopolygalacturonic acid lyase, 11:11937 (RA;US)
See Albersheim, P., 11:11951
Davis, L.L., Model for the mechanism and regulation of chitosan synthesis in Mucor rouxii, 11:11936 (RA;US)
Davis, M.J., Exponential separation and long-time correlation in collinear OCS, 11:11664 (J;NL)
Davis, M.S., BNL high-level waste technical assistance programs for support of the NRC, 11:11053 (J;US)
Review of DOE Waste Package Program. Semiannual report, October 1984-March 1985. Volume 8, 11:11025 (R;US)
See Schweitzer, D.G., 11:11054
Davis, R. Jr., Underground science at Homestake, 11:11842 (J;US)
See Fowler, W.A., 11:12177
Davis, R.F., *See* Edmond, J.A., 11:11555
Davis, W.E., Comparison of a multilayer regional-scale acid rain assessment model (MLRAPT) with a single-layer assessment model, RAPT, 11:11872 (R;US)
Dawkins, H.C., First observations of ecological surveillance plots on afforested open-cast spoil in South Wales. Occasional paper, 11:10810 (R;GB)
Dawson, L.R., *See* Gourley, P.L., 11:11588
See Jones, E.D., 11:11586
Dawson, P.R., NEPTUNE: a finite element code for creeping flow of saturated cohesive porous media (Version 1.0), 11:12035 (R;US)
Dawson, S., Capabilities of e^+e collisions for producing very heavy Higgs bosons, 11:12216 (J;NL)
de Botton, N., *See* Ghedira, M.L., 11:12294
de Goer, A.M., Thermal conductivity of neutron irradiated quartz, 11:11574 (R;FR)
See Villedieu, M., 11:11554
de Mascureau, J., *See* Sauneuf, A., 11:12426
Deacon, R.T., *See* Agarwal, V.B., 11:10936
Deady, M.A., *See* Suidan, M.T., 11:10803
Dean, D.A., Comparison of Schistosoma mansoni migration patterns in normal and irradiated cercaria-immunized mice by means of autoradiographic analysis. Evidence that worm elimination occurs after the skin phase in immunized mice, 11:11987 (R;US)
Dean, J.R., *See* Chiu, N.W., 11:11614
deBoisblanc, D.R., *See* Lake, J.A., 11:11283

Debrie, R., Characteristics of short distance field of a source radiating at electronic frequencies in a ionospheric plasma. Applications to density and electron temperature measurement by mutual impedance probe, 11:12056 (R;FR;In French)
DeBusk, T.A., *See* Ryther, J.H., 11:11170
Deeming, T., *See* Bowers, R.L., 11:12049, 11:12050
DeGroot, J.S., *See* Mizuno, K., 11:12509
Dei-Cas, R., Status report on the plasma-particle beam interaction experiment at Bruyeres-le-Chatel, 11:12475 (R;US)
Delahoy, A.E., Research on high-efficiency, single-junction, monolithic thin-film amorphous silicon solar cells. Semiannual subcontract progress report, 1 October 1984-31 March 1985, 11:11166 (R;US)
Deleplanque, M.A., *See* Macchiavelli, A.O., 11:12321
See Tjom, P.O., 11:12339
Delettrez, J., Simulation of experiments in spherical irradiation at $\lambda = 351$ nm, 11:12485 (R;US)
See Jaanimagi, P.A., 11:12490
Delmer, D.P., Regulatory mechanisms for the synthesis of β-glucans in plants, 11:11927 (RA;US)
Delnick, F.M., Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)
DeLuca, W.H., *See* Hornstra, F., 11:11363
DeLucia, J., Eddy currents in a nonperiodic vacuum vessel induced by axisymmetric plasma motion, 11:12500 (R;US)
Demarest, J.A., EUV beam-foil spectroscopy of highly ionized argon, 11:12074 (RA;US)
Performance of a grazing incidence spectrometer system employing a position sensitive microchannel plate detector for beam-foil measurements, 11:11816 (RA;US)
See Bandong, B., 11:12075
DeMason, D.A., Ultrastructure and biochemistry of endosperm breakdown in date palm (Phoenix dactylifera L.) seeds, 11:11938 (RA;US)
Dempsey, P.F., *See* Sammells, A.F., 11:11848
DeMuth, S.F., Prediction of flow rates through an orifice at pressures corresponding to the transition between molecular and isentropic flow, 11:11763 (R;US)
Denby, B.H., *See* Bhadra, S., 11:12165
Dentamaro, A.V., Renormalization scheme-dependence of perturbative quantum chromodynamics corrections to quarkonia, 11:12226 (R;US)
Derrig, G., K500 cyclotron magnet, 11:11795 (RA;US)
Deser, S., *See* Boulware, D.G., 11:12046
Deserio, R., *See* Glass, G.A., 11:12109
Deshou, L., *See* Kefa, C., 11:10873
Desrosiers, A.E., Accident assessment: role of the containment radiation monitor, 11:11340 (R;US)
Dethier, J.L., *See* Wilets, L., 11:12225
Detwiler, J.S., Athens automation and control experiment project review meeting, Dallas, Texas, December 5-6, 1984, 11:11223 (R;US)
Deurbrouck, A.W., *See* Killmeyer, R.P., 11:10859
Devismes, N., *See* de Goer, A.M., 11:11574
Diamond, P.H., *See* Sydora, R.D., 11:12437
Diamond, R.M., *See* Macchiavelli, A.O., 11:12321
See Tjom, P.O., 11:12339
Dias, H., Statistical decay of giant monopole resonance in ^{208}Pb, 11:12343 (R;BR)
Dias Vargas, F., Technical and economical feasibility studies and preliminary plan of a heavy water plant by the cryogenic distillation method of hydrogen, 11:11111 (R;CL;In Spanish)
Diaz, S., Influence of α sex factor on the biosynthesis of the cell wall from Saccharomyces cerevisiae, 11:11939 (RA;US)
Dickson, C.R., *See* Carlson, D.E., 11:11165
Didisheim, J.J., Single-crystal neutron diffraction study of the distribution and thermal motion of silver ions in alpha- and beta-Ag_2SI, 11:11573 (R;US)
Didocha, R.J., *See* Curtis, G.B. Jr., 11:11149
Diebold, G.J., *See* Choi, J.G., 11:11633
Diehl, E.K., Viscosity of low-rank coal slags, 11:10904 (RA;US)
Dietrich, F.S., *See* Annand, J.R.M., 11:12345
Difilippo, F.C., *See* Worley, B.A., 11:11287
DiMeo, D., *See* Dooher, J.P., 11:10796
Dimmler, D.G., FASTRUN: a high performance computing device for molecular mechanics using a pipeline architecture, 11:12519 (R;US)
Dinckiage, R.-D. von, Atomic L-subshell yields from the electron capture decays of ^{157}Tb and ^{158}Tb, 11:12333 (R;AU)
Dines, E.L., *See* Macchiavelli, A.O., 11:12321
Dingus, R.S., Model for optical-laser-induced impulse in vacuo, 11:12496 (R;US)
Dinsel, M.R., *See* Meininger, R.D., 11:11304
Dippold, D.G., Alternatives and optimization of the waste management system, 11:11056 (J;US)
Dirkes, W.E., *See* Rubey, W.A., 11:11603
Dirks, J.A., *See* Williams, T.A., 11:11177
Diver, R.B., *See* Kappauf, T., 11:11121
Divers, E.F., *See* Soroka, K.E., 11:10776
Divis, L.M., *See* Beug, M.U.D., 11:11847
Dobranich, D., TRAC-PF1/MOD 1 independent assessment: Semiscale MOD-2A feedwater-line break (S-SF-3) and steam-line break (S-SF-5) tests, 11:11331 (R;US)
Dobrev, V.K., Multiplet classification of the indecomposable highest weight modules over affine Lie algebras and invariant differential operators: the asub(l)sup((1)) example, 11:12227 (R;IT)
Multiplets of indecomposable highest weight modules over infinite-dimensional Lie algebras: The Virasoro - A_1 correspondence, 11:12228 (R;IT)
Dobrilovic, L., Measurement of the total specific alpha activity with silicon detector, 11:11828 (RA;AT)
See Novkovic, D., 11:11823
Doctor, P.G., *See* Apted, M.J., 11:11066
See Clark, R.A., 11:11256
Dodson, K.E., *See* Toth, L.M., 11:10988
Dodsworth, E.S., Relationships between electronic spectroscopy and electrochemistry. A probe of reorganisation energies. Technical report, 11:11638 (R;CA)
Doe, P.J., *See* Allen, R.C., 11:12168
See Chen, H.H., 11:11845
Doellstaedt, R., *See* Schmidt, J., 11:11713, 11:11714
Doerfel, B., Property of Euclidean Green functions of SU(2) Yang-Mills fields in BPST-instanton background, 11:12247 (R;SU)
Doerr, R.W., Calibration of an NDA neutron monitor for determining process holdup, 11:11087 (J;US)
Doherty, M.F., Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)
Doizi, D., *See* Mialocq, J.C., 11:11157
Domagala, R.F., *See* Williams, R.K., 11:11280
Dombsky, M., Inclusive measurement of (p,πsup(-)xn) double charge exchange reactions on bismuth from threshold to 800 MeV, 11:12344 (R;CA)
Domozych, D.S., Cytokinesis, wall development, and morphogenesis in green algal flagellates, 11:11957 (RA;US)
Donangelo, R.J., *See* Hussein, M.S., 11:12315
Dooher, J.P., Handling properties of coal water slurry fuels, 11:10796 (RA;US)
Dooley, W.T., *See* Thinnes, G.L., 11:11303
Doria, R.M., Gauge theory for composite fields, 11:12220 (R;BR)
High temperature interparticle potential for an alternative gauge model, 11:12219 (R;BR)
Two gauge fields in the same group, 11:12221 (R;BR)
Dougan, R.J., *See* Maguire, H.T., 11:12355
Douglas, R.A., *See* Schelin, H.R., 11:12298
Doverspike, L.D., *See* Champion, R.L., 11:12068
Dowell, M.R.W., Comparison of different methods of determining plutonium content and isotopic composition, 11:11622 (R;US)
Downing, D., *See* Christian, J., 11:11417
Dracoulis, G.D., *See* Poletti, A.R., 11:12340, 11:12341
Drahy, J., Steam turbines and reliability, 11:11245 (RA;CS;In Czech)
Drake, J., *See* Solomon, A.D., 11:11765
Drake, J.F., *See* Kleva, R.G., 11:12462
Dranitsaris, P., *See* Halton, D.M., 11:12008
Draper, J.E., *See* Macchiavelli, A.O., 11:12321
See Tjom, P.O., 11:12339
Draper, T., *See* Bernard, C., 11:12212
Dreier, R.B., *See* Boegly, W.J. Jr., 11:11027
Dressick, W.J., *See* Neyhart, G.A., 11:11175
Drickamer, H.G., *See* Roberts, E.R., 11:11690

Drischler, J.D., *See* Santoro, R.T., 11:12498
Driscoll, D.J., Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)
Drndarevic, V., *See* Dobrilovic, L., 11:11828
See Novkovic, D., 11:11823
Drndarevic, V.R., Pocket gamma ray monitor including semiconductor detector and numerical display, 11:11829 (RA;AT)
Drucker, H., *See* Gray, R.H., 11:10793
Drumm, P.V., Ground state mass excesses and low lying levels of the neutron rich nuclei ^{36}P, ^{35}P and ^{34}P, 11:12311 (R;AU)
See Fifield, L.K., 11:12310
Drummond, C.J., *See* Feeley, T.J. III, 11:10929
Drummond, T.J., *See* Jones, E.D., 11:11586
Dryer, F.L., Fuels combustion research, annual report, March 1, 1982-February 28, 1983, 11:11730 (R;US)
Dubay, D.T., *See* Shriner, D.S., 11:12009
DuBois, R.D., Coincidence techniques to study electron emission in ion-atom collisions, 11:12108 (J;NL)
Dubrovcak, P., Experience from monitoring reliability of V-1 nuclear power plant, 11:11248 (RA;CS;In Slovak)
Dubrovin, A.V., *See* Kogarko, S.M., 11:11738
Dubus, M., Ion channeling studies of $KTaO_3$:Nb, 11:11562 (J;GB)
Duckworth, W.H., *See* Rosenfield, A.R., 11:11553, 11:11561
Duclos, J., Antiproton-nucleon physics at LEAR, 11:12284 (R;FR;In French)
Status and future of the experiment PS 170 (anti pp $\rightarrow e^+e^-$), 11:12142 (R;FR)
Dudczak, R., Structurally modified fatty acids - clinical potential as tracers of metabolism, 11:11972 (R;US)
Duggan, J.L., *See* Andrews, M.C., 11:12110, 11:12111
Dugger, W.M., *See* Gould, J.H., 11:11940
Dugonjic, B., *See* Dvornik, I., 11:11827
Duke, T.W., Toxic effects on individuals, populations, and aquatic ecosystems and indicators of exposure to chemicals, 11:11916 (R;US)
Duletzky, S., *See* Anderson, E., 11:12026
Dumesnil, P., *See* Umiastowski, K., 11:11849
Dunin, V.B., *See* Vagner, V., 11:11804
Dunn, H.W., *See* Bamberger, C.E., 11:11564
Dunn, P.F., Magnetohydrodynamic natural convection heat transfer from horizontal cylinders, 11:11551 (J;GB)
Dunstall, T.G., Elemental tritium deposition and conversion in the terrestrial environment, 11:11899 (R;CA)
Duong-Van, M., *See* Hogan, G.E., 11:12169
Dupont, M., Study of solar solid adsorption ice-maker using 13 X zeolite - water couple in tropical climate, 11:11181 (RA;PR)
Durand, M., Semiclassical description of currents in normal and superfluid rotating nuclei, 11:12368 (R;FR)
Durbin, M.L., *See* Sexton, R., 11:11955
Dusek, J., Monte Carlo simulation assessment of emergency core cooling system reliability of nuclear power plants, 11:11317 (RA;CS;In Czech)
Dvornik, I., Possible secondary standard for lethal dose measurements in radiological research and accident dosimetry, 11:11827 (RA;AT)
See Ranogajec-Komor, M., 11:11825
Dworkin, A.S., Oxidation of arenes by molten gallium(III) chloride, 11:11696 (J;GB)
Dykhuizen, R.C., *See* Watkins, J.G., 11:12501
Dzhelepov, V.P., *See* Bystritskij, V.M., 11:12087
Dzomback, D.A., *See* Luthy, R.G., 11:10738

E

Easterling, J.C., Identifying barriers to the commercialization of low-Btu gasifiers, 11:11144 (R;US)
Eatough, C.N., *See* Germane, G.J., 11:10794
Ebbe, S., *See* Cohen, R.A., 11:11949
Ebbon, G.P., *See* Stephens, R.W., 11:10954
Ebinger, M.H., *See* Shackelford, S.A., 11:11694
Eboli, O.J.P., Decay rate of the false vacuum at high temperatures, 11:12236 (R;BR)
See Carvalho, C.A. de, 11:12237
Eckert, J., *See* Liapis, K., 11:11676
See Tomkinson, J., 11:11656
Edelman, R.A., Peat - a viable alternative for energy production, 11:10813 (RA;PR)
Edgar, T.F., *See* Chang, H.L., 11:10769
See Park, K.Y., 11:10767
Edmond, J.A., Amorphization and recrystallization processes in monocrystalline beta silicon carbide thin films, 11:11555 (R;US)
Efremenko, V.I., *See* Bayukov, Yu.D., 11:11925
Efremov, A.V., Multiquark states in nuclei and the deep inelastic scattering, 11:12370 (R;SU)
Efros, V.D., *See* Badalyan, A.M., 11:12286
Eggenberger, A., Multi-family houses with built-in conservatories, 11:11414 (RA;CH;In German)
Ehlotzky, F., Physics in Austria. Results of an investigation, 11:12272 (R;AT;In German)
Ehrlich, S., *See* McGowin, C.R., 11:10901
Einfeld, W., *See* Nelson, L.S., 11:11349
Einziger, R.E., Behavior of breached light water reactor spent fuel rods in air and inert atmospheres at 229°C, 11:11047 (J;US)
Eisberg, R.M., *See* Goulding, F.S., 11:12325
Eissenberg, D.M., *See* Greenstreet, W.L., 11:11273
Ekberg, S.A., *See* Jones, L.H., 11:11655
Ekchian, J.E., *See* Assanis, D.N., 11:11487
Ekmann, J., Flow characteristics of coal-water mixtures. Final report, September 1, 1981-September 30, 1984, 11:10912 (R;US)
El-Naggar, I.M., *See* Misak, N.Z., 11:11612
Elbel, C., *See* Kuncicky, P., 11:11247
Eliezer, S., Muon catalyzed fusion - fission reactor driven by a recirculating beam, 11:12494 (R;US)
See Morrison, P.J., 11:12434
Ellington, R.T., *See* Starling, K.E., 11:11674
Ellingwood, B., *See* Hwang, H., 11:11225
Elliot, J., Solar and energy-conserving food technologies: a training manual, 11:11195 (R;US)
Elliott, D.C., *See* Butner, R.S., 11:11132
Elliott, J.R., *See* Dana, G.F., 11:10749
Ellis, A.B., *See* Carpenter, M.K., 11:11571
Ellis, F.B. Jr., *See* Delahoy, A.E., 11:11166
Ellis, K.J., *See* Glaros, D., 11:11980
Ellis, M.J., *See* Mirin, A.A., 11:12463
Ellis, R.B., *See* Simpson, L.A., 11:11503
Ellis, R.G., *See* Choudhury, S.R., 11:12210
Ellsworth, R.W., *See* Yodh, G.B., 11:12151
Elsbett, L., New diesel engine development for the use of vegetable oil as a fuel, 11:11500 (RA;DE;In German and English)
Elston, S.B., *See* Glass, G.A., 11:12109
Emery, A.F., *See* Mortazavi, H.R., 11:10771
Emmert, G.A., *See* Kulcinski, G.L., 11:12493
Emswiler, T.R., Phase I decontamination of the J.C. Haynes site, Newark, Ohio. Final report, 11:11004 (R;US)
Engar, P., *See* Glass, G.A., 11:12109
Engdahl, R.B., Energy from wastes, current technology, 11:11147 (RA;PR)
England, C., *See* Funk, J.E., 11:11123
England, T.R., *See* LaBauve, R.J., 11:11269
See Wilson, W.B., 11:11254
Engleman, V.S., Feasibility of wet oxidation for combustion of coal slurries, 11:10878 (RA;US)
Epstein, R., *See* Delettrez, J., 11:12485
See Jaanimagi, P.A., 11:12490
Erbert, G.V., *See* Crane, J.K., 11:12092
Erickson, D.C., *See* Eztergalyos, J., 11:11224
Erkkila, B. H., *See* Waechter, D. A., 11:11838
Erkkila, B.H., Automatic material identifier, 11:11101 (J;US)
Erley, W., *See* Noonan, J.R., 11:12123
Errede, S., *See* Bionta, R.M., 11:11843
Erwin, J., *See* Sefer, N.R., 11:11502
Escobar, C.O., *See* Caruso, F., 11:12178
Esdorn, H., Influence of the way the process is carried out on the economic efficiency of indoor air conditioning equipment - a practice report, 11:11434 (RA;DE;In German)
Eser, E., *See* Delahoy, A.E., 11:11166
Eshom, E.P., *See* Whitfield, M.S. Jr., 11:11040
Essenhigh, R.H., Effect of in-situ heat treatment on coal char reactivity. Engineering kinetics of coal pyrolysis and combustion in normal and high intensity flames. Progress report, 11:10908 (R;US)
Effect of in-situ heat treatment on coal char reactivity. Ostwald equations and

combustion efficiency in hydrocarbon and coal flames. Progress report, 11:10909 (R;US)
Essink, J.P.O., *See* Ronde, H., 11:10754
Estabrook, K.G., *See* Mizuno, K., 11:12509
Estand, E., First international workshop on battery testing. Workbook and extended abstracts. Summaries, 11:11368 (R;US)
Esztergalyos, J., The application of synchronous clocks for power system fault location, control and protection, 11:11224 (BA;US)
Etheredge, R.S., *See* Sweeten, J.M., 11:11134
Ethridge, F.G., *See* Marcouiller, B.A., 11:10751
Eubank, H.P., *See* Grisham, L.R., 11:12511
Euker, C.A. Jr., Catalytic Coal Gasification Process Development Unit operation, 11:10737 (RA;US)
Eustis, R.H., Investigation of fluid-bed combustion of municipal solid waste, 11:11483 (R;US)
Evans, G.H., Numerical modeling of a solid particle solar central receiver, 11:11178 (R;US)
Evans, J.C., *See* Olsen, K.B., 11:10969
Evans, J.S., Health effects model for nuclear power plant accident consequence analysis. Part I. Introduction, integration, and summary. Part II. Scientific basis for health effects models, 11:11997 (R;US)
Evans, J.V., Zirconium molybdate gel as a generator for technetium-99m, 11:11716 (R;AU)
Evans, M.I., Firewood versus alternatives: domestic fuel in Mexico. Occasional paper, 11:11150 (R;GB)
Eveleigh, D.E., *See* Stoke, H.W., 11:11145
Ewing, R.H., Fuel Performance Improvement Program. Progress report, April 1984-March 1985, 11:11232 (R;US)
Eyres, A.R., *See* Stephens, R.W., 11:10954

F

Faber, J. Jr., *See* Richardson, J.W. Jr., 11:11557
Fabre, *See* Charvillat, 11:10987
Fabry, R., *See* Patigny, J., 11:10745
Fahey, J.A., X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6O$/sub 2-0.5x/ system, 11:11651 (J;US)
Fahlander, C., *See* Poletti, A.R., 11:12340
Faibis, A., *See* Kanter, E.P., 11:12117
Fairchild, R.G., Microanalytical techniques for boron analysis using the $^{10}B(n,\alpha)^7Li$ reaction, 11:11981 (J;US)
Falk, W.R., *See* Ziegler, W., 11:12305
Fankhauser, J., Converting an agricultural tractor to biogas turbojet operation, 11:11486 (RA;DE;In German and English)
Farias, J.R., Conventional Hamiltonian for first-order differential systems, 11:12413 (R;BR)
Farkas, D., *See* Sun, T., 11:10779
Farlow, G.C., *See* Oliver, W.C., 11:11556
See White, C.W., 11:11563
Farmer, J.D., Scaling in fat fractals, 11:12521 (R;US)
Farrar, M.B., *See* Corbett, B.L., 11:11290
Farrell, M.P., Carbon Dioxide Information Center FY 1985 progress report, 11:11867 (R;US)
Fathy, D., *See* Holland, O.W., 11:11594, 11:11596
Faulkner, A.R., Coal water slurry barge delivery to Boston Edison Mystic 4 for a demonstration test burn, 11:10849 (RA;US)
Fearing, H.W., Radiative reactions in two and three nucleon systems, 11:12288 (R;CA)
Federer, J.I., Crystallization behavior of coal gasification ash, 11:10805 (J;US)
Fedorenko, O.M., *See* Akhundov, A.A., 11:12203
Feeley, T.J. III, Application of acute bioassays in evaluating the treatment of coal liquefaction wastewaters, 11:10929 (J;US)
Feher, I., Investigations of a new thermoluminescent bulb dosimeter, 11:11824 (RA;AT)
Feher, J., *See* Hofmann, W., 11:11993
Feher, S., Dose level measurements during startup of the first unit of the PAKS nuclear power plant, 11:11279 (RA;AT)
Fehlau, P.E., The Pajarito Monitor: a high-sensitivity monitoring system for highly enriched uranium, 11:11840 (J;US)
Fehringer, J.M., *See* Beahm, D.M., 11:11305
Felt, R., *See* Bonzon, L.L., 11:11343
Felcher, G.P., Magnetic depth profiles by neutron reflection, 11:11508 (R;US)
Feldman, E.E., *See* Planchon, H.P., 11:11299
Feng, W.W., Finite deformation of viscoelastic rotating disks, 11:11753 (J;GB)
Fernandes, N.C., Grassmann-Schoenberg algebras and grand unification, 11:12240 (R;BR;In Portuguese)
Homotopy and statistics in quantum theory, 11:12404 (R;BR)
See Cattani, M.S.D., 11:12238, 11:12239
Fernow, R., *See* Chung, S.U., 11:12140
Ferrari Junior, N.F., Effect of collisions on the mechanism of isotope separation by ion-cyclotron waves, 11:12441 (R;BR)
Ferrandi, G., *See* Geiger, D.K., 11:11682
Ferreira, P.L., Aspects of hadronic structure, 11:12235 (R;BR;In Portuguese)
Ferrell, P.C., *See* Pitner, A.L., 11:11315
Ferrell, T.L., *See* Vo-Dinh, T., 11:11608
Ferrell, W.L., *See* Kolaczkowski, A.M., 11:11347
Ferris, R.H., *See* Clark, R.A., 11:11256
Festin, P.M., *See* Bliss, C., 11:10892
Fewell, M.P., Collectivity of $^{160,161}Yb$ at high spin, 11:12120 (J;US)
See Burnett, S.M., 11:12326
Fields, L.W., *See* Cooley, J.N., 11:10982
Fifield, L.K., Masses and level schemes of ^{33}Si and ^{34}Si, 11:12310 (R;AU)
See Drumm, P.V., 11:12311
Fil'chenkov, V.V., *See* Bystritskij, V.M., 11:12087
Filleux, C., Parametric studies: Direct-gain windows, conservatories and convective systems, 11:11415 (RA;CH;In German)
Fillmore, G.N., *See* Lake, J.A., 11:11283
Fillo, J.P., *See* Gray, R.H., 11:10793
Filpus-Luyckx, P.E., *See* Beug, M.U.D., 11:11847
Finch, S.J., *See* Thode, H.C. Jr., 11:11398
Fine, R., *See* Dimmler, D.G., 11:12519
Finicle, D.P., Stress analysis of the LOFT inspection fixture periscope and camera storage stand, 11:11240 (R;US)
Finlay, R.W., *See* Annand, J.R.M., 11:12345
Fischer, C.F., Theoretical studies of atomic transitions. Progress report, March 15, 1985-March 14, 1986, 11:12077 (R;US)
Fischer-Ayloff-Cook, K.P., Refrigerated foods in bulk containers - influence of the way processing is done on the microbiological stability of instant dishes, 11:11467 (RA;DE;In German)
Fisk, Z., *See* Gandra, F., 11:11535
See Golding, B., 11:11536
Fite, W.E., Western Resource Transport project: a liquid carbon dioxide/coal slurry pipeline, 11:10850 (RA;US)
Flagan, R.C., *See* Gavalas, G.R., 11:10905
Flatt, J.H., Optical and electrochemical study of model zinc electrode pores in alkaline electrolyte, 11:11699 (R;US)
Fleck, B.H., *See* Andrews, J.W., 11:11412
Fleming, D.G., *See* Arseneau, D.J., 11:12091
Flesher, D.J., *See* Henrie, J.O., 11:11079
Fletcher, E.A., *See* Kappauf, T., 11:11121
Fletcher, T.H., *See* Holve, D.J., 11:10870
Fleury, N., New weak boson decays and possible spin 3/2 leptons, 11:12186 (R;BR)
Possible interaction between spin-1/2 and spin-3/2 fields, 11:12179 (R;BR)
Florit, M.I., *See* Skotheim, T.A., 11:11701
Flower, P.S., *See* Apsimon, R.J., 11:11837
Foley, J.K., 30-MeV electron-beam irradiation effects on GaAs(1-x)P(x) LEDS (light emitting diodes). Master's thesis, 11:11572 (R;US)
Foley, L.O., *See* Morgenstern, M.H., 11:11327
Follstaedt, D.M., Binary and ternary amorphous alloys of ion-implanted Fe-Ti-C, 11:11527 (R;US)
See Knapp, J.A., 11:11528
Fonck, R.J., *See* Ida, K., 11:12448
Fonseca Teixeira, A.F. da, *See* Costa, J.L.C., 11:12038
Forberg, S., Encapsulation of spent nuclear fuel in ceramic materials. An introductory study, 11:11024 (R;SE)
Ford, A.L., *See* Becker, R.L., 11:12102
Ford, J.L.C. Jr., *See* Shapira, D., 11:12308
Ford, M.K., *See* Hamrick, T.P., 11:11285
Foster, G.W., *See* Bionta, R.M., 11:11843
Fourney, W.L., *See* Shukla, A., 11:11569
Fournier, D., Photothermal investigation of transport in semiconductors: Theory and experiment, 11:11590 (J;US)
Foust, C.B., *See* Jones, D.W., 11:10918
Fowler, R.H., *See* Morris, R.N., 11:12497
Fowler, W.A., Discussion on a national underground science facility (NUSF), 11:12177 (J;US)
Fox, P., *See* Suidan, M.T., 11:10803
Foy, J., *See* Abegglen, F., 11:11799

Fraley, G., Rayleigh—Taylor stability for a normal shock wave—density discontinuity interaction, 11:12133 (J;US)
Framatome, G.S., *See* Antonini, G., 11:10826
Francis, C.W., *See* Maskarinec, M.P., 11:11484
Francisco, G., Quasiclassical approximation for ultralocal scalar fields, 11:12234 (R;BR)
Francois, O., *See* Antonini, G., 11:10826
Frank, A.M., Laser-illuminated nanosecond microscope, 11:11754 (J;US)
Frank, J.S., *See* Hogan, G.E., 11:12169
Frank, R.M., *See* Assanis, D.N., 11:11487
Franke, F.H., *See* Guntermann, K., 11:10760
Franke, P.R., *See* Nunz, G.J., 11:11201
Frazier, J.C., *See* Seidman, G., 11:12014
Frazier, M.E., Viabilities and mutation frequencies of CHO-K1 cells following exposure to 60-Hz electric fields, 11:12025 (R;US)
Freed, J.H., ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
See Barkley, P.G., 11:11650
Freeland, M.H., Basic data report for borehole DOE-1. Waste Isolation Pilot Plant (WIPP) Project, Southeastern New Mexico, 11:11045 (R;US)
Freeman, J.R., Magnetic-field extraction and filamentation of high-current electron beams, 11:12094 (J;US)
Freese, J.M., *See* Magnani, N.J., 11:11372
Freidberg, J.P., *See* Berk, H.L., 11:12436
Freihaut, J.D., *See* Seery, D.J., 11:10784
Frekers, D., *See* Kutschera, W., 11:11726
Frenkel, J., *See* Carneiro, C.E.I., 11:12184
Frere, J., Naturalness for multiscalar models and radiative stability, 11:12263 (J;US)
Fresko, M., *See* Nelson, L.S., 11:11349
Frey, R.M., Characteristics of insulating oil for electrical applications. Volume 1. Evaluation of insulating oils for use in transformers, capacitors, and cables. Final report, 11:11772 (R;US)
Characteristics of insulating oil for electrical applications. Volume 2. Effect of copper and aluminum on two types of paraffinic insulating oils. Final report, 11:11773 (R;US)
Friedli, C., Activation analysis, 11:11609 (RA;US)
Friedman, P.L., *See* Hewitt, W.M., 11:11052
Friedrich, F.D., *See* Rowley, D.R., 11:10879
Fritz, L.J., *See* Jones, E.D., 11:11586
Frois, B., Subnucleon freedom degrees, 11:12358 (R;FR;In French)
Frye, S.L., *See* Smith, R.D., 11:11620
Fu, Y.C., Combustion tests of beneficiated and micronized coal-water fuels: use of internal-mix atomizer and rotary-cup burner, 11:10886 (RA;US)
Fuchs, E.F., Optimization of induction motor efficiency. Volume 3. Experimental comparison of three-phase standard motors with Wanlass motors. Final report, 11:11478 (R;US)
Fuchs, N.H., *See* Acharya, R., 11:12261
Fuerstenau, D.W., Characterization of coal surfaces. Technical progress report, August 21-November 20, 1985, 11:10856 (R;US)
Fuji, A., *See* Treves, S., 11:11717
Fujii, A.T., Phosphorescence in irradiated spodumene, 11:11582 (R;BR)
Fuller, G.M., Stellar weak interaction rates: the issue of quenching, 11:12360 (R;US)
Fuller, J.F., *See* Dautresme, B., 11:10764
Fultz, B., Temperature dependence of the ^{57}Fe hyperfine magnetic field distribution in Fe-Ni, 11:11522 (R;US)
Fultz, E., *See* Taylor, R.T., 11:12011
Funk, J.E., Solar thermochemical hydrogen: the heat source-process interface, 11:11123 (J;GB)
Furman, R.C., Capital and operating costs for commercial scale coal-water slurry preparation plants, 11:10914 (RA;US)
Furth, H.P., *See* White, R.B., 11:12449
Fuselier, S.A., *See* Gary, S.P., 11:12057

G

Gabel, D., *See* Fairchild, R.G., 11:11981
Gabetta, G., *See* Cullen, W., 11:11524
Gabriel, T.A., High Energy Transport Code HETC, 11:12373 (R;US)
Gadelle, C., Oxidation kinetics and models for self ignition of coal in underground gasification, 11:10768 (RA;US)
UCG tests at la Haute-Deule - first results, 11:10747 (RA;US)
See Pavone, D., 11:10753
Gagliardi, C., *See* Mihara, Y., 11:11820
Gagliardi, C.A., Proton beam position and intensity monitors, 11:11787 (RA;US)
Gagnon, A., Advanced physical fine coal cleaning microbubble flotation. Topical report No. 1. GHH-Bergbau Forschung microbubble coal flotation machine, 11:10857 (R;US)
Gaisser, T., *See* Fowler, W.A., 11:12177
Gaisser, T.K., Physics with underground leptons of atmospheric origin, 11:12173 (J;US)
Gajewski, W., *See* Bionta, R.M., 11:11843
Galasiewicz, Z.M., Spin-hydrodynamic equations with external disturbances and suitable Green's functions for superfluid ^{3}He-B. New Onsager relations, 11:12137 (J;US)
Galetti, D., From GCM energy kernels to Weyl-Wigner Hamiltonians: a particular mapping, 11:12403 (R;BR)
Gallaher, R.B., *See* Greenstreet, W.L., 11:11273
Gallant, W.D., *See* Aston, T.R.C., 11:10819
Galvao, R.M.O., *See* Ferrari Junior, N.F., 11:12441
Gambhir, Y.K., *See* Pannert, W., 11:12376
Gambill, V.M., *See* Bright, R.W., 11:11991
Gamp, A., *See* Kox, S., 11:12302
Gan, W., *See* Solomon, S.B., 11:12388
Gandit, P., *See* Bonjour, E., 11:11505
Gandra, F., ESR in a heavy-fermion alloy (UBe_{13}) doped with local moments, 11:11535 (J;US)
Ganguli, S.G., Behavior of ionized plasma in the high latitude topside ionosphere. Memorandum report, 11:12054 (R;US)
Gao, J., Analysis on droplet burning histories of different coal liquid mixtures, 11:10869 (RA;US)
Gao, L.J., *See* Wang, Y.S., 11:10882
Garcia, A.A., *See* Kolaczkowski, A.M., 11:11347
Garcia, C., *See* Fehlau, P.E., 11:11840
Gardner, W.L., *See* Tsai, C.C., 11:12479
Garg, U., *See* Sullivan, J.P., 11:11819
Garner, D.M., *See* Arseneau, D.J., 11:12091
Garofalini, S.H., Local structure of metal atoms in silica and silicates. Progress report, May 15-December 1, 1985, 11:11578 (R;US)
Garrett, B.C., Nuclear-motion corrections to Born-Oppenheimer barrier heights for chemical reactions, 11:11640 (R;US)
See Blais, N.C., 11:12059
See Tucker, S.C., 11:12062
Gary, S.P., Electromagnetic instabilities and gyrophase-bunched particles, 11:12057 (J;US)
See Tsurutani, B.T., 11:12058
Gash, B.W., *See* Barone, S.P., 11:10755
Gaspar, P.P., Laser photolysis of 2-phenylheptamethyltrisilane, 11:11709 (J;NL)
Gast, P., Determination of the amount and the type of quinones present in single crystals from reaction center protein from the photosynthetic bacterium Rhodopseudomonas viridis, 11:11705 (J;NL)
Gat, U., Ultimate Safe (US) Reactor, 11:11300 (R;US)
Gaug, M., *See* Nelson, L.S., 11:11349
Gauger, G.A., *See* Frey, R.M., 11:11772, 11:11773
Gavai, R.V., Velocity of sound in SU(3) lattice gauge theory, 11:12262 (J;US)
Gavalas, G.R., Combustion of calcium-exchanged coal. Eighth quarterly report, 11:10905 (R;US)
Gedemer, T.J., *See* Frey, R.M., 11:11772
Geertsma, W., *See* Oosten, A.B. van, 11:11518
Geiger, D.K., Redox reactivity of transition-metal phthalocyanines: ligand radical formation vs. metal center oxidation, 11:11682 (J;US)
Geist, G.A., Modeling of complex melting and solidification behavior in laser-irradiated materials [a description and users guide to the LASER8 computer program], 11:11584 (R;US)
Geist, W.M., Flavour tagging of parton jets, 11:12144 (R;US)
Gel'fand, B.E., *See* Borisov, A.A., 11:11736
Genti, R., *See* Stadlbauer, J.M., 11:12090
Gentry, W.R., *See* Hall, G., 11:12098
George, D.C., *See* LaBauve, R.J., 11:11269
George, M.V., *See* Murty, B.A.R.C., 11:11706
Georgi, J.R., *See* Dean, D.A., 11:11987
Gerl, J., *See* Poletti, A.R., 11:12341
Germain, M., *See* Vialard, E., 11:10983
Germane, G.J., Characterization and combustion of low-rank coal-water slurries, 11:10794 (RA;US)
Gersdorff, H.P. von, *See* Doria, R.M., 11:12221
Gershtejn, S.S., Superhigh energy charmed particles penetration in matter, 11:12188 (R;SU)

Gertz, C.P., Management of TRU waste at the Idaho National Engineering Laboratory, 11:11049 (J;US)

Gessiness, B., The results of the NLO error propagation exercise, 11:11099 (J;US)

Geyer, B., *See* Doerfel, B., 11:12247

Ghedira, M.L., Measurement of cross sections of total nuclear photon absorption by the ^{12}C and ^{208}Pb nuclei in the Δ(1232) region, 11:12294 (R;FR;In French)

Ghoneimy, H.F., *See* Misak, N.Z., 11:11612

Ghosh, A.K., *See* Gaspar, P.P., 11:11709

Giambiagi, M., *See* Giambiagi, M.S. de, 11:11641

Giambiagi, M.S. de, Some considerations about bond indices in non-orthogonal bases and the MO calculation of valence and oxidation number, 11:11641 (R;BR)

Gibb, M., Welding of carbon steel vessels without post weld heat treatment, 11:11521 (R;CA)

Gibbs, L.L., Removal of n-alcohols from an aqueous stream using micellar-enhanced ultrafiltration, 11:11672 (R;US)

Gibson, B.F., Few-body strange systems, 11:12372 (R;US)

Structure of the $^3H \rightarrow n + d(d^*)$ vertexes, 11:12292 (BA;NL)

Gibson, W.G., Classification of vulnerability information, 11:11094 (J;US)

Giese, C.F., *See* Hall, G., 11:12098

Gignoux, C., *See* Silvestre-Brac, B., 11:12195

Gilbert, E.S., Analysis of various aspects of atomic bomb dose estimation at RERF using data on acute radiation symptoms, 11:12005 (J;US)

Gilbert, W., *See* Taylor, C.E., 11:11805

Giles, G.L., *See* Ziegler, W., 11:12305

Gill, R.L., Recent developments at TRISTAN: nuclear structure studies of neutron-rich nuclei, 11:11792 (R;US)

See Hill, J.C., 11:12283

See Wolf, A., 11:12327

Gillen, K.T., *See* Bonzon, L.L., 11:11343

Gillies, C.W., Molten carbonates: microwave studies of the vapor state. Final report, 11:11406 (R;US)

Gillies, G.T., Precision limits of lock-in amplifiers below unity signal-to-noise ratios, 11:11775 (J;US)

Ginsberg, T., Aerosol generation by liquid breakup resulting from sparging of molten pools of corium by gases released during core/concrete interactions, 11:11355 (J;US)

Liquid jet breakup characterization with application to melt-water mixing, 11:11295 (R;US)

Girard, D., Optimal regularization methods and their applications for tomography: new performing image reconstruction algorithms, 11:11975 (R;FR;In French)

Girardi, F., *See* Cadelli, N., 11:11016

Giraud, N., Real and virtual pions in nuclei, 11:12287 (R;FR;In French)

Girvin, D.C., *See* Olsen, K.B., 11:10969

Glantz, C.S., *See* Davis, W.E., 11:11872

Glaros, D., In vivo measurement of lithium in the body by a neutron activation analysis technique, 11:11980 (J;US)

Glas, A.R., *See* Robinson, D.G., 11:11930

Glasgow, B.B., Effects of irradiation and high heat flux on the lifetime performance of ferritic and 316 stainless steels, 11:11530 (R;US)

Review of failure criteria for thin wall structures in a high heat flux environment, 11:12508 (R;US)

Glass, G.A., Electron capture to the continuum from atomic hydrogen, 11:12109 (J;NL)

Glasser, R.G., JADE: search for new particles and tests of Standard Model, 11:12146 (RA;US)

See Chang, C.Y., 11:11807, 11:12147

See Yodh, G.B., 11:12151

Glassman, I., *See* Dryer, F.L., 11:11730

Glebov, I.A., Design problems of reliable turbogenerators 2, 11:11271 (RA;CS;In Russian)

Glickfeld, B.W., Quasi-automatic parallelization: a simplified approach to multiprocessing, 11:12517 (R;US)

Glowienka, J.C., Comparative measurement of the neutral density and particle confinement time in EBT, 11:12444 (R;US)

Gmitro, M., *See* Christillin, P., 11:12303

Gocksch, A., *See* Gavai, R.V., 11:12262

Godfrey, S., Effects of anomalous Zsup(O) decays on neutrino counting near the Zsup(O), 11:12255 (R;CA)

Goetzenberger, R., Expansion chambers in the refrigeration circuit, 11:11475 (RA;DE;In German)

Gold, A., *See* Nesnow, S., 11:11870

Golden, G.H., *See* Planchon, H.P., 11:11299

Goldflam, R., *See* Wilets, L., 11:12225

Goldhaber, M., *See* Bionta, R.M., 11:11843

Golding, B., Observation of a collective mode in superconducting UBe_{13}, 11:11536 (J;US)

Goldman, A.S., The analysis of tank calibration data from several runs, 11:11100 (J;US)

Goldman, J.H., *See* Chung, S.U., 11:12140

Goldman, L., *See* Elliot, J., 11:11195

Goldman, S.R., *See* Dingus, R.S., 11:12496

Goldstick, R.J., *See* Taback, H.J., 11:10968

Goldstone, J.A., *See* Liapis, K., 11:11676

See Nelson, R.O., 11:12387

See Tomkinson, J., 11:11656

Gollin, G.D., [Review of experiments measuring CP nonconservation], 11:12154 (R;US)

Gollnow, K., Investigation of air-cooled condensing units with hermetic twin compressors from the point of view of energetics, 11:11473 (RA;DE;In German)

Golutvin, I.A., *See* Veresh, I., 11:11833

Gomez, C., *See* Parker, J., 11:12492

Gomez del Campo, J., *See* Shapira, D., 11:12308

Gomi, K., *See* Holve, D.J., 11:10870

Gomont, J., *See* Antonini, G., 11:10826

Gonzalez, E.M., *See* Lopez-Romero, E., 11:11942

Gonzalez, W.R., *See* Pack, R.W., 11:11314

Goodell, J.R., *See* Nimick, F.B., 11:12033

Goodman, J.A., *See* Yodh, G.B., 11:12151

Goodman, M.M., *See* Dudczak, R., 11:11972

Googin, J.M., *See* Compere, A.L., 11:11499

Goranson, P.L., *See* Nelson, B.E., 11:12481

Gorbunov, N.V., *See* Veresh, I., 11:11833

Gorden, M., *See* Bliss, C., 11:10892

Gordon, C.C., *See* Tourangeau, P.C., 11:10812

Gordon, J.S., *See* Ryan, R.B., 11:10884

Gorenflo, D., *See* Steimle, F., 11:11382

Gorez, R., Models of the thermal state in an underground gasification well, 11:10766 (RA;US)

Gorman, V.W., *See* Thinnes, G.L., 11:11303

Goshgarian, B.B., *See* Shackelford, S.A., 11:11694

Gouffon, P., *See* Wolynec, E., 11:12334

Gould, G.D., *See* McKinsey, R.R., 11:10756

Gould, H., Charge changing cross sections of relativistic uranium, 11:12116 (J;NL)

Gould, J.H., Utilization of glucose and UDPG by supprotoplasts of cotton fiber cells, 11:11940 (RA;US)

Gould-Stewart, S., Low-frequency variability in a climate model with a mixed-layer ocean, 11:11860 (R;US)

Goulding, F.S., Heavy-ion identification using detector telescopes, 11:11839 (BA;US)

The LBL/UCSB ^{76}Ge double beta decay experiment: first results, 11:12325 (J;US)

See Loo, B.W., 11:11979

Gourley, P.L., Optical imaging of dislocations in strained-layer superlattices and lattice-mismatched epilayers, 11:11588 (R;US)

See Jones, E.D., 11:11586

Goutte, D., Quadrupole boson densities in the germanium region by inelastic electron scattering, 11:12328 (R;FR)

Goyert, J.C., *See* Maskarinec, M.P., 11:11484

Grach, I.L., Analysis of eigenvalues for the energy dependent potentials and NN interaction in the quark compound bag model, 11:12197 (R;SU)

Graham, W.B., *See* Holmes, N.C., 11:12136

Gram, P.A.M., *See* Minehart, R.C., 11:12293

Granetz, R., *See* Parker, J., 11:12492

Granier, O., *See* Leray, S., 11:12348

Granifo, J., *See* Geiger, D.K., 11:11682

Granozzi, G., *See* Beach, D.B., 11:11659

Graves, R.S., *See* Williams, R.K., 11:11280

Gray, K.E., *See* Felcher, G.P., 11:11508

Gray, L.M., Emphasis: an active management model, 11:11105 (J;US)

Gray, M.N., System tests for studying the release of radioactivity from high-level waste forms under geological disposal conditions, 11:11067 (RA;US)

Gray, R.H., Coal conversion (liquefaction/gasification): engineering considerations and relationships among physical, chemical and toxicological properties of resulting materials, 11:10793 (R;US)

Graziadio, M., *See* Michele, G.D., 11:10874

Green, A.E.S., Improved combustion of coal water mixtures, 11:10895 (RA;US)

Greenberg, D., *See* Fairchild, R.G., 11:11981
Greenberg, J., *See* Bionta, R.M., 11:11843
Greenberg, S., Corrosion of ceramic refractories exposed to a synthetic coal slag by means of the rotating-drum technique, 11:11552 (R;US)
Greenblatt, M., *See* Wang, E., 11:11361
Greenborg, J., *See* Henrie, J.O., 11:11079
Greene, E.F., Silicon (111) and (100) surfaces and their interactions with Sc, K, Na and Li; phase changes and kinetics of desorption studied by surface ionization, 11:11667 (J;NL)
Greenstreet, W.L., Aging and service wear of check valves used in engineered safety-feature systems of nuclear power plants. Volume 1. Operating experience and failure identification, 11:11273 (R;US)
Greenwald, M., *See* Parker, J., 11:12492
Greenwood, D.E., *See* Baylor, L.R., 11:12477
Gregory, D.C., Indirect processes in electron impact ionization of multiply-charged ions, 11:12106 (J;NL)
See Miller, P.D., 11:12118
Gregory, D.L., *See* Smallwood, D.O., 11:11748
Greif, R., *See* Evans, G.H., 11:11178
Greiner, D., *See* Gould, H., 11:12116
Greiner, M., *See* Steimle, F., 11:11382
Greiner, W., *See* Cusson, R.Y., 11:12306
Grest, G.S., *See* Anderson, M.P., 11:11546
Greve, L.C., Xylanase action on alfalfa cell walls, 11:11928 (RA;US)
Griesmeyer, J.M., *See* McKone, T.E., 11:11356
Griest, W.H., Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Griffith, B.F., *See* Hargrove, M.J., 11:10893
Griffith, W.L., *See* Compere, A.L., 11:11499
Grimes, B.K., *See* Desrosiers, A.E., 11:11340
Grimm, W., Planning and operating instructions for agricultural batch drying machinery with air-pre-heating by means of solar energy, 11:11189 (RA;DE;In German)
Grimsrud, D.T., *See* Sextro, R.G., 11:11873
Grinzi, F., *See* Mills, B., 11:10872
Grisham, L.R., Neutral beam heating system for the tokamak fusion test reactor, 11:12511 (J;NL)
Groebner, R.J., *See* Seraydarian, R.P., 11:12459
Groeger, J., *See* Hadlock, D.E., 11:11836
Groenewold, G.H., Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas, 11:10802 (RA;US)
Grolimund, R., *See* Filleux, C., 11:11415
Grothaus, K.R., *See* Magnani, N.J., 11:11372
Grout, P.J., *See* Roman, E., 11:11519
Grover, J.R., *See* Walters, E.A., 11:11679
Gruber, D.F., Immunologic and hematologic perturbations in models of combined injury, 11:11989 (R;US)
Gruenewald, T., Irradiation as a process in competition with deep-freezing, 11:11116 (RA;DE;In German)
Gruhle, W.D., Controlling a cooling medium evaporator with an electrically-driven injection valve, 11:11465 (RA;DE;In German)
Improvement of operational behaviour of a heating system equipped with a water/air source heat pump, 11:11435 (RA;DE;In German)
Grumm, D.M., *See* Goulding, F.S., 11:12325
Gruneisen, M.T., *See* Albrecht, G.F., 11:11761
Grunenberg, H., Balance-sheet of a large-scale heat pump system for heating a residential complex, 11:11432 (RA;DE;In German)
Gu, J.W., *See* Wang, Y.S., 11:10882
Guay, K.P., *See* Nelson, L.S., 11:11349
Guerin, M.R., *See* Griest, W.H., 11:10919
Guetermann, A., *See* Binz, A., 11:11416
Guettler, G., Optimisation of large-scale industrial refrigeration, 11:11470 (RA;DE;In German)
Guezet, D., *See* Chemin, J.F., 11:12317
Gugelot, P.C., *See* Minehart, R.C., 11:12293
Guidry, M.W., *See* Fewell, M.P., 11:12120
Guillaume, B., Chemical properties of neptunium applied to neptunium management in extraction cycles of Purex process, 11:10984 (R;FR)
Gunn, R.D., *See* Bell, G.J., 11:10752
See Britten, J.A., 11:10763
See Dautresme, B., 11:10764
See Tantekin, S.B., 11:10770
Guntermann, K., Simulation of UCG in great depth, 11:10760 (RA;US)
Guo, C., *See* Xie, M., 11:10889
Guo, C.T., Approach to deashing of some Chinese coals by oil-agglomeration method, 11:10830 (RA;US)
Guoquan, H., *See* Mingjiang, N., 11:10871
Gupta, A.R., *See* Iyer, R.M., 11:11647
Gupta, R., Improved Monte Carlo Renormalization Group Method, 11:12252 (R;US)
Gupta, S., *See* Yodh, G.B., 11:12151
Gupta, V.P., Report on CFRMF fission product loop study, 11:12329 (R;US)
Gutmacher, R.G., *See* Markin, J.T., 11:11092
Gwo, D., *See* Ray, D., 11:12096
Gyllander, C., *See* Hoffman, F.O., 11:11904

H

Haaf, S., Development trends in refrigeration equipment for supermarkets, 11:11424 (RA;DE;In German)
Haas, P.M., *See* Laughery, K.R. Jr., 11:11266
Haber, E.P., Study and application of ion chromatography and activation analysis without chemical separation for the determination of sodium and potassium in muscle tissues, 11:11615 (R;BR;In Portuguese)
Hadlock, D.E., Electrochemical development of particle tracks in CR-39 polymer dosimeter, 11:11836 (R;US)
Haegel, N.M., Transient and temperature-dependent phenomena in Ge:Be and Ge:Zn far infrared photoconductors, 11:11583 (R;US)
Haemmerle, W.H., *See* Golding, B., 11:11536
Haenni, D.R., Cyclotron control system, 11:12069 (RA;US)
See Bronson, J.D., 11:11796, 11:11801
See Sullivan, J.P., 11:11819
Hafemeister, D., Energy sources: conservation and renewables, 11:11450 (B;US)
See Rosenfeld, A., 11:11452
Haggerty, J.S., Laser-heated CVD process for depositing thin films for low-cost solar cell applications. Annual subcontract progress report, 1 February 1984-31 May 1985, 11:11168 (R;US)
Hagopian, V., *See* Chung, S.U., 11:12140
Hahm, T.S., *See* Sydora, R.D., 11:12437
Hahn, S., Effects of thermal donor generation and annihilation upon oxygen precipitation, 11:11587 (R;US)
Hahne, B., *See* Hoffmann, F., 11:11960
Hahne, G., *See* Hoffmann, F., 11:11960
Haider, G., Potential of micronized coal-water slurry as an alternate fuel in oil- and gas-fired boilers, 11:10885 (RA;US)
Hailey, C.J., *See* Burkhalter, P.G., 11:11760
Haines, T.J., *See* Bionta, R.M., 11:11843
Haire, R.G., *See* Bamberger, C.E., 11:11725
Haisler, R., Trim coil power supplies, 11:11798 (RA;US)
Hald, D.L., *See* Goulding, F.S., 11:12325
Hale, D.A., *See* Allen, G.H., 11:10940
Hall, G., State-to-state vibrational excitation of I_2 in collisions with H_2 and D_2, 11:12098 (J;US)
Hall, L.D., *See* Adam, M.J., 11:11723
Haller, E.E., *See* Yu, K.M., 11:11543
Hallin, A.L., *See* Hogan, G.E., 11:12169
Halton, D.M., Toxicity levels to humans during acute exposure to hydrogen fluoride, 11:12008 (R;CA)
Hama, Y., Resolution of hydrodynamical equations for transverse expansions. Part 1, 11:12130 (R;BR)
Resolution of hydrodynamical equations for transverse expansions. Part 2, 11:12131 (R;BR)
Hamagaki, H., *See* Tanihata, I., 11:12307
Hambley, D.F., *See* Rote, D.M., 11:10997
Hamblin, D.M., Engineering/economic end-use energy models, 11:11375 (J;US)
Hamkens, J., Most efficient way of transforming natural gas into heat, cooling and electricity, 11:11471 (RA;DE;In German)
Hamm, R.N., *See* Wright, H.A., 11:12389
Hammett, G.W., *See* Wong, K.L., 11:12464
Hammond, E.C., *See* Oliver, F.W., 11:11411
Hamrick, T.P., Oak Ridge Research Reactor quarterly report July, August, and September 1985, 11:11285 (R;US)
Hanan, N., *See* Shiu, K.K., 11:11292
Hanan, N.A., *See* Ilberg, D., 11:11291
Hand, L., *See* Skuja, A., 11:11808
Hanebuth, P., Chromosome investigations on persons whose mothers have been treated with ionizing radiations during

pregnancy, 11:11995 (R;DE;In German)
Hanig, M., Process design criteria for a plant producing nitrogen-15, 11:11112 (R;US)
Hanna, A.F., Global low order spectral model designed for climate sensitivity studies, 11:11862 (R;US)
Hannachi, F., *See* Chemin, J.F., 11:12317
Hanninen, H., *See* Cullen, W., 11:11524
Hansen, G.E., Rossi Alpha Method, 11:11284 (R;US)
Hanson, R.C., New high-pressure phase of solid CO_2, 11:11652 (J;US)
Hao, F., *See* Wang, Z., 11:10833
Hardekopf, R.A., *See* Brown, R.E., 11:12289
Harder, J.D., "Rancho Hydro": a low-head, high volume residential hydroelectric power system, Anahola, Kauai, Hawaii, 11:11151 (R;US)
Hargis, C., *See* Bronson, J.D., 11:11796, 11:11801
See Haenni, D.R., 11:12069
Hargrove, M.J., Performance characteristic of coal-water fuels and their impact on boiler operation, 11:10893 (RA;US)
Harker, Y.D., *See* Gupta, V.P., 11:12329
See Proctor, A.E., 11:11108
Harmon, B.A., *See* Shapira, D., 11:12308
Harmon, L.H., The radioactive waste disposal problem has a solution - the Waste Isolation Pilot Plant project, 11:11051 (J;US)
Harms, N.L., *See* Byers, K.R., 11:11085
Harnad, J., *See* Legare, M., 11:12258
Haroldsen, R., Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, WNP, Unit Nos. 1 and 3 (Docket Nos. 50-460 and 50-508), 11:11262 (R;US)
Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, Hope Creek Generating Station (Docket No. 50-354), 11:11306 (R;US)
Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, Seabrook Units 1 and 2 (Docket Nos. 50-443 and 50-444), 11:11307 (R;US)
Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, River Bend, Unit 1, 11:11308 (R;US)
Conformance to Generic Letter 83-28 Items 3.1.3 and 3.2.3, Shearon Harris Unit 1 (Docket No. 50-400), 11:11309 (R;US)
Harper, F.T., *See* Benjamin, A.S., 11:11345
Harris, D.R., *See* Maguire, H.T., 11:12355
Harris, W. G., Heat flux limiting sleeves, 11:11259 (P;US)
Harrison, W., *See* Rote, D.M., 11:10997
Hart, J.S., Ecosystem studies at the Los Medanos site, Eddy County, New Mexico. Volume I, 11:11042 (R;US)
Harty, R., *See* Reece, W.D., 11:11998
Harz, H.P., Tests on deep-freeze reactions of liquid foods using pulsed NMR spectroscopy, 11:11117 (RA;DE;In German)
Hasekoester, H., Remote monitoring of refrigeration and air conditioning systems with the air of BBC-York's TELEGUARD system, 11:11474 (RA;DE;In German)
Haselton, H.H., *See* Tsai, C.C., 11:12479
Hashimoto, O., *See* Tanihata, I., 11:12307
Hasselbring, L.C., *See* Vannice, M.A., 11:11654
Hassenzahl, W., *See* Taylor, C.E., 11:11805
Hassib, A.M., Recurrence relation for the calculation of sections of compound conical concentrators, 11:11161 (RA;PR)
Hastings, D.E., Bifurcation phenomena and the radial electric field in a nonaxisymmetric plasma, 11:12461 (J;US)
See Spong, D.A., 11:12443
Hastings, S.R., IEA Solar Task 8: Passive and hybrid use of solar energy, 11:11185 (R;CH;In German and French)
Hatfield, R., *See* Nevins, D.J., 11:11929
Hattula, J.S., *See* Fewell, M.P., 11:12120
Hauer, A., *See* Jaanimagi, P.A., 11:12490
Hauptmann, M., *See* Kaplan, E., 11:12028
Hausammann, R., *See* Allen, R.C., 11:12168
Hauser, P.R., *See* Curado, E.M.F., 11:12395
Hauserman, W.B., Production and combustion of hot-water-dried lignite slurries, 11:10827 (RA;US)
Hausser, I., *See* Herth, W., 11:11954
Havlicek, M., *See* Blank, V., 11:12248
Hawkins, G.T., CoaLiquid, Inc. coal slurry fuels commercial program - 1985, 11:10843 (RA;US)
Hawley, P.M., Demonstration of shield-type longwall supports at Kaiser Steel Corporation's No. 1 mine, Utah. Open File report February 1980-April 1982, 11:10926 (R;US)
Hay, H.J., *See* Dincklage, R.-D. von, 11:12333
Hayashi, T., Macromolecular organization of xyloglucan and cellulose in pea epicotyls, 11:11970 (RA;US)
Haynes, H.W. Jr., Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985, 11:10785 (R;US)
See Penner, H.A., 11:10759
Hayns, M.R., Cascade-induced fluctuations and the transition from the stable to the critical cavity radius for swelling, 11:11510 (R;US)
Heagle, A.S., *See* Shriner, D.S., 11:12009
Heap, M.P., *See* Payne, R., 11:11221
Heath, R.L., *See* Gupta, V.P., 11:12329
Heatherly, D.E., *See* Brynestad, J., 11:11565, 11:11658
Hedley, A.B., Droplet size distribution changes during the atomization of a coal water slurry, 11:10864 (RA;US)
Heffter, J.L., *See* Schubert, J.F., 11:11864
Hege, H., Thermal insulation and carbon dioxide enhancement in greenhouses, 11:11421 (RA;DE;In German)
Heidbrink, W., *See* Wong, K.L., 11:12464
Heimann, R.B., *See* Gray, M.N., 11:11067
Hein, D.F., *See* Frank, A.M., 11:11754
Heinemann, R.E., Progress toward the second respository--status, 11:11055 (J;US)
Heintzmann, H., Pulsar precession: a nod is not as good as a wink, 11:12037 (R;BR)
Helayel Neto, J.A., *See* Doria, R.M., 11:12219, 11:12220
Held, G.A., Chaos and turbulence in an electron-hole plasma in germanium, 11:11523 (R;US)
Hellwege, H.E., *See* Bamberger, C.E., 11:11725
Hendel, H., *See* Wong, K.L., 11:12464
Hendricks, J.S., *See* Booth, T.E., 11:12122
Henke, B.L., *See* Jaanimagi, P.A., 11:12490
Henley, E.M., *See* Wilets, L., 11:12225
Hennart, D., Case of Three Mile Island, 11:11242 (R;BE;In French)
Heaning, W., *See* Kutschera, W., 11:11726
Hearle, J.O., Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)
Henry, *See* Charvillat, 11:10987
Henry, Ph., *See* Sauneuf, A., 11:12426
Heary, R.J., Electron collisions with positive ions. Progress report, April 1, 1985-March 31, 1986, 11:12079 (R;US)
Henscheid, J.W., Technical evaluation of the G.E. Transportable Modular AZTECH Plant topical report, 11:11014 (R;US)
Technical evaluation of the topical report on the Koch Process Systems Low-Level Radwaste Volume Reduction System, 11:11015 (R;US)
Henshall, C.A., *See* Wadsworth, J., 11:11542
Herdade, S.B., *See* Arruda Neto, J.D.T., 11:12352, 11:12353
Herman, E.M., Immunocytochemical and cytochemical evidence for an intracellular role for plant Golgi apparatus, 11:11959 (RA;US)
Herman, M.G., *See* Coimbra, M.M., 11:12313
Herrmann, R.B., L/sub g/ wave excitation and propagation with application to nuclear yield determination. Final report 1 Apr 83-31 Mar 85, 11:11854 (R;US)
Herth, W., Chitin and cellulose fibrillogenesis in vivo and their experimental alteration, 11:11954 (RA;US)
Hensch, B., Fission-like phenomena for systems with mass A=110, 11:12312 (R;FR)
Hensi, P., *See* Hogan, G.E., 11:12169
Hewing, G., *See* Knoblauch, K., 11:10743
Hewitt, W.M., Implementation status of NWPA requirements and relevant activities of the repository projects, 11:11052 (J;US)
Heywood, J.B., *See* Assanis, D.N., 11:11487
Hibbs, M., *See* Baltay, C., 11:12166
Hickok, R.L., *See* Schoch, P.M., 11:12469
Higgins, R.S., Modelling of heat transfer and furnace conditions in pulverised coal fired boilers, 11:11214 (RA;US)
Higuchi, H., *See* Sato, K., 11:12380
Hilbert, C., dc SQUIDs as radiofrequency amplifiers, 11:11752 (J;US)
Measurements of the dynamic input impedance of a dc SQUID, 11:11751 (J;US)
Hildebrandt, B.W., *See* Miller, F.C., 11:10978
Hill, D.N., *See* Watkins, J.G., 11:12501
Hill, J.C., Study of magnetic moments of nuclear excited states at TRISTAN, 11:12283 (J;NL)
See Wolf, A., 11:12327
Hill, M.K., Ultrafiltration of Kraft Black Liquor. Final report, Phase I, 11:11476 (R;US)

Hill, R.W., Results of the Centralia underground coal gasification field test, 11:10744 (RA;US)
Hill, V.L., GRI perspective on UCG as an SNG supply option, 11:10757 (RA;US)
Hillsman, E.L., *See* Bjornstad, D.J., 11:11133
See Jones, D.W., 11:10918
Himmelblau, D.M., *See* Chang, H.L., 11:10769
Hindin, B., *See* Razgaitis, R., 11:11413
Hinds, S., *See* Burnett, S.M., 11:12326
Hingerty, B.E., *See* Betzel, C., 11:11697
See Saenger, W., 11:11946
Hinkebein, T.E., Field test of drag reducing agents in a three-inch pipeline at the West Hackberry, Louisiana SPR site, 11:10957 (R;US)
Hippler, R., Atomic effects of electrons and protons at low energies, 11:12066 (R;US)
Hiragari, T., FACOM VP supercomputer of parallel pipeline processing system has achieved 7.5 ns machine cycle, 11:12525 (TG;US)
Hiromoto, R., Parallel-processing a large scientific problem, 11:12526 (B;US)
Hirschfeld, T., *See* Carey, W.P., 11:11629
Hirschfeld, T. B., Nonsaturable microdryer, 11:11779 (P;US)
Hirshman, S.P., *See* Shaing, K.C., 11:12460
Hirst, E., Determinants of actual electricity savings after retrofit: electrically heated homes in the Pacific Northwest, 11:11420 (R;US)
Hlatky, L., Two-dimensional diffusion limited system for cell growth, 11:11985 (R;US)
Ho, C., *See* Griest, W.H., 11:10919
Ho, P., Theoretical study of the heats of formation of SiH/sub n/, SiCl/sub n/, and SiH/sub n/Cl/sub n/ compounds, 11:11653 (J;US)
Hock, G., *See* Berenyi, D., 11:12086
Hockin, R.L., *See* Dawkins, H.C., 11:10810
Hockney, G., *See* Bernard, C., 11:12212
Hodge, W.L., *See* Isler, R.C., 11:12468
Hodgkinson, D., Specification of a test problem for HYDROCOIN Level 1 Case 4: transient thermal convection in a saturated permeable medium, 11:10995 (R;GB)
Hodgson, P.E., *See* Wilmore, D., 11:12323
Hoepfer, A., Central refrigeration for use in supermarkets, 11:11426 (RA;DE;In German)
Hoff, R.W., *See* Maguire, H.T., 11:12355
Hoffman, C.M., *See* Hogan, G.E., 11:12169
Hoffman, D.J., *See* Baity, F.W., 11:12428
See Tsai, C.C., 11:12479
Hoffman, F.O., Comparison of predictions from internationally recognized assessment models for the transfer of selected radionuclides through terrestrial food chains, 11:11904 (J;US)
Hoffmann, F., Are cortical microtubules essential for cell formation and cell division by isolated callus protoplasts?, 11:11960 (RA;US)
Hoffmann, R., *See* Schmidt-Boecking, H., 11:12105
Hofmann, W., Monte Carlo calculations in environmental monitoring - applicability and limitations, 11:12520 (RA;AT)
Stochastic lung dose modelling. A joint Austrian-Hungarian project, 11:11993 (RA;AT)
Hogan, G.E., Progress report on recent rare muon decay experiments at the Los Alamos meson physics facility, 11:12169 (J;NL)
Holder, G., Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985, 11:11142 (R;US)
Holian, B.L., Classical response theory propagators: An illustrative example, 11:12422 (J;US)
Holland, J.Z., *See* Baer, F., 11:11857
Holland, O.W., Dose rate dependence of damage clustering during heavy ion irradiation in Si, 11:11594 (J;GB)
Dose rate effects in silicon during heavy ion irradiation, 11:11596 (J;NL)
See Pennycook, S.J., 11:11600
Hollingsworth, R.E., *See* Sites, J.R., 11:11167
Hollo, E., Guidelines for reliability analysis of control elements and systems of nuclear power plants, 11:11276 (RA;CS;In German)
Holmes, N.C., Spontaneous Raman scattering from shocked water, 11:12136 (J;US)
Holmes, S.A., *See* Robertson, R.E., 11:10967
Holroyd, R.A., *See* Munoz, R.C., 11:11686
Holten, D., *See* Gaspar, P.P., 11:11709
Holter, G.M., *See* Oak, H.D., 11:11339
Holve, D.J., Comparative combustion studies of ultrafine coal/water slurries and pulverized coal, 11:10870 (RA;US)
Holzfuss, J., Approach to error-estimation in the application of dimension algorithms, 11:12421 (R;US)
See Layne, S., 11:11978
Hong, B.G., Renormalized turbulence theory of ion pressure gradient driven drift modes, 11:12432 (R;US)
Hong, J., Exact dynamically convergent calculations of the frequency-dependent density response function, 11:12418 (J;US)
Honjo, S., *See* Naka, A., 11:10839
Hood, M., *See* Hawley, P.M., 11:10926
Hopke, P.K., Study of the atmospheric chemistry of /sup 218/Po. Final report, August 21, 1983-December 31, 1985, 11:11882 (R;US)
Hopkins, W.C., *See* Wilson, W.B., 11:11254
Horacek, L., Statistical approach to safety assessment of WWER reactor pressure vessels, 11:11318 (RA;CS;In Czech)
Hornak, J.P., *See* Barkley, P.G., 11:11650
Hornstra, F., First international workshop on battery testing, 30 September-2 October 1985, Heidelberg, FRG. Summary report, 11:11364 (R;US)
Testing activities at the National Battery Test Laboratory, 11:11363 (R;US)
Horton, W., *See* Liu, J., 11:12435
Horton, W. Jr., *See* Hong, B.G., 11:12432
Horvath, F.J., *See* Stocker, H., 11:11077
Horwitz, G., Thermodynamic stability of cosmological models, 11:12045 (J;US)
Hotchkis, M.A.C., *See* Drumm, P.V., 11:12311
See Fifield, L.K., 11:12310
Hou, W., *See* Bengtsson, H., 11:12213
Houf, W.G., *See* Evans, G.H., 11:11178
Houk, R.S., Mass spectrometry of inductively coupled plasmas, 11:11624 (J;US)
See Olivares, J.A., 11:11625
Houlberg, W.A., *See* Selcow, E.C., 11:12429
Housholder, W.R., *See* Barlow, C.R., 11:11746
Houtman, H., FORTRAN program (RELAX3D) to solve the 3 dimensional Poisson (Laplace) equation, 11:12409 (R;CA)
How, J.A., *See* Corbould, M.A., 11:12473
Howard, J., *See* Tomkinson, J., 11:11656
Howe, M.A., *See* Storm, D.W., 11:11802
Howell, J., *See* Russell, N.S., 11:11084
Howerton, R.J., *See* Perkins, S.T., 11:12309
Hrazsky, M., Experience from data acquisition for assessment of component life in V-1 nuclear power plant, 11:11251 (RA;CS;In Slovak)
Hsie, A.W., *See* Recio, L., 11:12006
Hsieh, T.C., Probing the wave function of a surface state in Ag(111): A new approach, 11:11537 (J;US)
Hsu, J.Y., Hot-electron ring formation in tokamak plasmas, 11:12458 (J;US)
Stability of electron cyclotron waves in the presence of strong electron cyclotron heating, 11:12440 (R;US)
Hsu, W.L., *See* Bastasz, R., 11:12471
See Watkins, J.G., 11:12501
Hu, P.S., *See* Detwiler, J.S., 11:11223
Huang, J.C., Analytical solution for a first-order reaction in a packed bed with diffusion, 11:11665 (J;US)
Huang, S.J., *See* Hadlock, D.E., 11:11836
Huang, Y., *See* Ravn, H.L., 11:12065
Huang, Z.X., *See* Gao, J., 11:10869
Huang Weigang, *See* Wang Yuzhu, 11:12083
Huber, D.J., Possible role for hemicelluloses in fruit softening, 11:11941 (RA;US)
Hucko, R.E., *See* Killmeyer, R.P., 11:10859
Huertas, E.J., *See* Betancourt, S.R., 11:11146
Huff, D.D., *See* Boegly, W.J. Jr., 11:11027
Hughes, M.R., *See* Cooley, J.N., 11:10982
Hughes, W.L., Physicochemical rationale for the biological activity of mercury and its compounds, 11:12015 (J;US)
Hui, E.T., *See* Walters, E.A., 11:11679
Hui, W.C., *See* Maimoni, A., 11:11373
Huie, R.E., One-electron redox reactions in aqueous solutions of sulfite with hydroquinone and other hydroxyphenols, 11:11683 (J;US)
Hulett, L.D., *See* Rosseel, T.M., 11:12115
Hull, A.B., *See* Rote, D.M., 11:10997
Hull, J.R., Major design, and operational considerations of salt-gradient solar ponds, 11:11183 (RA;PR)
Hulse, R.A., *See* Ida, K., 11:12448
Hulsey, S.D., *See* Jackson, M.C., 11:12455
Hulth, P.O., Identification of neutral Higgs bosons in the Delphi detector at Lep, 11:12211 (R;SE)
Hultqvist, K., *See* Hulth, P.O., 11:12211

Humenick, M.J., Biotreatment of UCG condensate and pattern water, 11:10765 (RA;US)
Humphrey, A.E., Description and status of the Byrne Creek power project, 11:10746 (RA;US)
Hungate, R., *See* Greve, L.C., 11:11928
Hunt, J.E., *See* Gast, P., 11:11705
Hunter, S.R., Temperature dependent electron transport studies for diffuse discharge switching applications, 11:11770 (R;US)
Hunter, T.O., Workshop on the source term for radionuclide migration from high-level waste or spent nuclear fuel under realistic repository conditions: proceedings, 11:11061 (R;US)
Hurford, N., Use of airborne microwave radiometry for the detection and investigation of oil slicks at sea, 11:10939 (R;US)
Hurley, J.P., Sodium in low-rank coal, 11:10797 (R;US)
Hurst, G.S., Radiochemical solar neutrino experiment using $^{81}Br(nu, e^-)^{81}Kr$, 11:12172 (J;US)
Hussein, M.S., Back-angle scattering of antiprotons from nuclei, 11:12301 (R;BR)
Description of antiproton-nucleus scattering with the proton-nucleus Dirac impulse approximation optical potential, 11:12300 (R;BR)
Effects of the dynamic α-transfer polarization potential in the large-angle scattering of $^{16}O+^{28}Si$, 11:12315 (R;BR)
Polarization potentials in heavy ion scattering, 11:12364 (R;BR)
Theory of the heavy ion fusion cross section, 11:12363 (R;BR)
See Aleixo, A.N.F., 11:12366
See Almeida, F.I.A. de, 11:12367
See Carlson, B.V., 11:12318, 11:12319, 11:12320
Hutchinson, D.P., *See* Walker, M.A., 11:12445
Hutchinson, I.H., *See* Kato, K., 11:12446
Hutton, P.H., On-line acoustic emission monitoring of nuclear reactor systems: status and future, 11:11270 (R;US)
Hvelplund, P., *See* Datz, S., 11:12107
Hwang, H., Structural load combinations, 11:11225 (R;US)
See Pires, J., 11:11332

I

Ida, K., Some effects of MHD activity on impurity transport in the PBX tokamak, 11:12448 (R;US)
Igarasi, S., *See* Murata, T., 11:12279
Ilberg, D., Review of the turbine-building flooding study of the Oconee PRA, 11:11291 (R;US)
See Shiu, K.K., 11:11292
Ilic, R., *See* Miric, I., 11:12391
Illman, D.L., *See* Carey, W.P., 11:11629
Im, C.J., *See* Looney, J.H., 11:10854, 11:10855
Imazawa, Y., *See* Sato, K., 11:12380
Ingelman, G., Ideas on the pomeron-proton interaction at the parton level, 11:12182 (R;CH)
Intaranont, K., *See* Ayoub, M.M., 11:12027
Iqbal, M.J., *See* Thaler, J., 11:12253
Iriarte, M., Correlations between short term and long term wind observation data in Ceer Toa Baja energy experimental farm, 11:11205 (RA;PR)
Iriarte, M. Jr., Design of a centralized network for data acquisition of wind, solar and environmental parameters by using the existing radio telemetry seismic network in Puerto Rico, 11:11206 (RA;PR)
Irizarry, J.G., *See* Molini, A.E., 11:11159
Irwin, G.R., *See* Shukla, A., 11:11569
Isaacson, A.D., *See* Tucker, S.C., 11:12062
Isermann, R., *See* Gruhle, W.D., 11:11435
Isidro Filho, M.P., *See* Carlson, B.V., 11:12318, 11:12319, 11:12320
See Hussein, M.S., 11:12300, 11:12301
Islam, A.K.M.A., Ion model and dipole polarizabilities in energy calculations, 11:11580 (R;IT)
Isler, R.C., Long-time impurity confinement as a precursor to disruptions in ohmically heated tokamaks, 11:12468 (J;US)
Isotani, S., *See* Fujii, A.T., 11:11582
Itoh, S., Effects of chloride depletion on electron donation from the water-oxidizing complex to the photosystem II reaction center as measured by the microsecond rise of chlorophyll fluorescence in isolated pea chloroplasts, 11:11174 (J;NL)
Ivanov, A.V., Concentration limits of hydrogen ignition in air in mixtures with non-combustible gases under normal circumstances, 11:11735 (RA;XA)
Iyer, R.M., Studies on inorganic ion exchangers. Fundamental properties and application in nuclear energy programmes, 11:11647 (RA;XA)
Iyer, R.S., Gas-phase reactions of atomic chlorine with vinyl chloride, 11:11685 (J;US)
Izumo, M., *See* Sakurai, T., 11:11021

J

Jaanimagi, P.A., Thermal transport: a comparison between solid and shell targets, 11:12490 (R;US)
Jackson, A.D., Nuclear matter theory: a status report, 11:12379 (J;US)
Jackson, D.H., *See* Olson, J., 11:11335
Jackson, D.P., Review of fusion breeder blanket technology. Part 1. Review and findings, December 1984, 11:12476 (R;CA)
Jackson, M.C., Electrical configuration for magnetic drift pumping on the tandem mirror experiment-upgrade (TMX-U), 11:12455 (R;US)
Jackson, T.L., Shock-induced thermal runaway, 11:11733 (R;US)
Jacobi, S., Fast reactor status review. Development work on core protective instrumentation, 11:11358 (TJ;GB)
Jacobs, F., *See* Janicki, A., 11:11909
Jacobs, P.T., *See* Close, J.A., 11:11233
Jacobs, S.C., *See* Hanig, M., 11:11112
Jacobs, W.W., *See* Brown, R.E., 11:12289
Jacobson, R.H., *See* Dean, D.A., 11:11987
Jagadeesh, A., Potential of wind energy in Rajasthan state (India): a case study, 11:11204 (RA;PR)
Jahn, A., *See* Esdorn, H., 11:11434
Jaklevic, J.M., *See* Yu, K.M., 11:11543
James, G.D., Energy recovered by using balloons and cylinders, 11:11207 (RA;PR)
Janata, E., Baseline compensation circuit for measurement of transient signals, 11:11776 (J;US)
Janicki, A., Upper bay network: a study of the plankton resources of the upper Chesapeake Bay. Volume 1, text. Volume 2, Appendices a-o. Final report 1982-1983, 11:11909 (R;US)
Jankowski, R.A., *See* Organiscak, J.A., 11:10924
Janney, J.L., *See* Shackelford, S.A., 11:11694
Janos, A., *See* Jardin, S.C., 11:12499
Jardin, S.C., Amplification of S-1 Spheromak current by an inductive current transformer, 11:12499 (R;US)
Jarmie, N., Low-energy nuclear reactions with hydrogen isotopes, 11:12290 (J;NL)
See Brown, R.E., 11:12289
Jaroszewicz, T., Induced charges and tunneling in soliton-antisoliton systems, 11:12260 (J;US)
Jasinschi, R.S., New contributions to the cosmological constant, 11:12041 (R;BR)
Quantization of the fermionic sector in N=1, D=11 supergravity, 11:12241 (R;BR)
Jaung, R., *See* Ludewig, H., 11:11297
Jawetz, P., Alcohols and ideas for savings of petroleum crude at local refineries in the Caribbeans, 11:11136 (RA;PR)
Jayasooriya, U.A., *See* Liapis, K., 11:11676
Jehle, R., Comparative studies on deep freeze distribution vehicles, 11:11497 (RA;DE;In German)
Jellison, G.E. Jr., Time-resolved reflectivity measurements of silicon and germanium pulsed excimer laser irradiation, 11:11576 (R;US)
Jen, E., *See* Umberger, D.K., 11:12420
Jennings, W.C., *See* Schoch, P.M., 11:12469
Jensen, K.J., *See* Kutschera, W., 11:11726
Jin, D.F., *See* West, C.A., 11:11934
Jira, S., Reliability information system for conventional and nuclear power plants, 11:11217 (RA;CS;In Czech)
Jivan, S., *See* Adam, M.J., 11:11724
Jo, J.H., *See* Rohatgi, U.S., 11:11234
Joel, D.D., *See* Lefevre, M.E., 11:12010
Johnson, B., *See* Fite, W.E., 11:10850
See Schmidt-Boecking, H., 11:12105
Johnson, B.M., Synchrotron radiation production and trapping of highly charged ions, 11:12112 (J;NL)
See Meron, M., 11:12104
Johnson, C.A., *See* Musikant, S., 11:11490
Johnson, C.K., *See* Chang, T.C., 11:11688
Johnson, D.W., Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)
Johnson, J.K., *See* Mrochek, J.E., 11:10791
Johnson, J.R., *See* Hadlock, D.E., 11:11836

See Reilly, J.J., 11:11567
Johnson, M.A., *See* Suidan, M.T., 11:10803
Johnson, N.R., *See* Fewell, M.P., 11:12120
Johnson, R.A., *See* Barclay, R. Jr., 11:10789
Johnson, R.L., Advanced Toroidal Facility, 11:12478 (R;US)
Johnson, R.R., *See* Shepard, C.L., 11:11532
Johnson, S.A., *See* Wagner, J. Jr., 11:10887
Johnson, W.N., *See* Hanig, M., 11:11112
Johnston, J.W. Jr., *See* Shriner, D.S., 11:12009
Johnston, R.G., *See* Allen, C.C., 11:11030
Jolly, W.L., *See* Beach, D.B., 11:11659
Jonas, L.A., *See* Thompson, J.K., 11:11782
Jonasson, K.A., *See* Bennett, A., 11:10881
Jones, C.M., *See* Miller, P.D., 11:12118
Jones, D.C., *See* Swan, S.A., 11:10923
Jones, D.P., *See* Sons, R.J., 11:11104
Jones, D.R.T., *See* Bjoerkman, J.E., 11:12265
Jones, D.W., Factors affecting the rent to surface-mined coal tracts in the Powder River Basin and Green River/Hams Fork Region, 11:10918 (R;US)
Jones, E.D., Pressure-dependent magneto-optic measurements in strained-layer superlattices at low temperatures, 11:11586 (R;US)
Jones, G., *See* Ziegler, W., 11:12305
Jones, J.F., *See* Motley, E.P., 11:10795
Jones, K.W., *See* Johnson, B.M., 11:12112
See Meron, M., 11:12104
See Panessa-Warren, B.J., 11:11965
See Schmidt-Boecking, H., 11:12105
Jones, L.H., Infrared spectra and structure of thin films of solid oxygen, 11:11655 (J;US)
Jones, R.G., *See* Germane, G.J., 11:10794
Jones, T.D., Guidance document for prioritizing supplemental monitoring around synfuels facilities, 11:10922 (R;US)
Jones, T.W., *See* Bionta, R.M., 11:11843
Jonsson, O.C., *See* Ravn, H.L., 11:12065
Jorge, F.E., *See* Giambiagi, M.S. de, 11:11641
Joshi, A.V., Alternative method for the removal of oxides of nitrogen and sulfur from combustion processes. First quarterly technical status report, September 17-December 31, 1985, 11:10788 (R;US)
Joshi, G.C., *See* Choudhury, S.R., 11:12210
Joubert, J.I., *See* Fu, Y.C., 11:10886
Justiniano, E., *See* Schmidt-Boecking, H., 11:12105

K

Kabakchi, S.A., Formation of hydrogen in the radiolysis of water in closed volumes, 11:11711 (RA;XA)
Kaczvinsky, J.R. Jr., Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 11:11635 (D;US)
Kadar, I., *See* Berenyi, D., 11:12086
Kaeline, E., *See* Vane, C.R., 11:12114
Kaeline, J., *See* Minehart, R.C., 11:12293
See Vane, C.R., 11:12114
Kahn, C., *See* Seraydarian, R.P., 11:12459
Kahn, S.A., *See* Baltay, C., 11:12166
Kaidalov, A.B., Fragmentation functions for quarks and diquarks in the model of quark-gluon strings, 11:12200 (R;SU)
Kaita, R., *See* Wong, K.L., 11:12464
Kalashnikova, Yu.S., Nucleon-nucleon forces in the quark compound bag model and few-nucleon systems, 11:12199 (R;SU)
$^1S_0$ and $^3S_1$ - $^3D_1$ nucleon-nucleon potentials in the quark compound bag model, 11:12198 (R;SU)
See Grach, I.L., 11:12197
Kalchev, B., *See* Pavlov, V., 11:11321
Kalinnikov, V.A., Fast-response analog-to-digital processor for event selection by the difference in numbers of particles, 11:11835 (R;SU;In Russian)
Kalinoski, H.T., *See* Smith, R.D., 11:11620
See Wright, B.W., 11:11630
Kaljevic, J., *See* Miric, I., 11:12391
Kallir, A.J., *See* Vo-Dinh, T., 11:11689
Kalyniak, P., *See* Godfrey, S., 11:12255
Kammerer, O.F., *See* Suenaga, M., 11:11531
Kamperschroer, J.H., *See* Grisham, L.R., 11:12511
Kampwirth, R.T., *See* Felcher, G.P., 11:11508
Kane, R.J., *See* Jackson, M.C., 11:12455
Kanevskij, B.L., *See* Gershtejn, S.S., 11:12188
Kang, S.K., Pilot-scale combustion tests of CWM for a modified water-tube package oil boiler at KIER, 11:10875 (RA;US)
Kanter, E.P., Final-charge-state-dependence in the production of foil-excited heavy Rydberg atoms, 11:12117 (J;NL)
Kao, S.W., *See* Suidan, M.T., 11:10803
Kao-yu, H., Calculation of sliding interfaces of two-dimensional unsteady flow, 11:11767 (TG;US)
Kapila, A.K., *See* Jackson, T.L., 11:11733
Kaplan, C., *See* Panessa-Warren, B.J., 11:11965
Kaplan, E., Guidebook for the assembly and use of diverse ground water data, 11:12028 (R;US)
Kaplun, S.M., Optimization of reliability and quality of power sources in power systems, 11:11244 (RA;CS;In Russian)
Kappauf, T., Hydrogen and sulfur from hydrogen sulfide-4. Quenching the effluent from a solar furnace, 11:11121 (J;GB;RU)
Karamyan, S.A., Observation of a long-lived nuclear quasimolecule in the $^{20}Ne + Ge$ system, 11:12324 (R;SU;In Russian)
Karney, C.F.F., Fokker-Planck and quasilinear codes, 11:12453 (R;US)
Karol, P.J., Experimental nuclear and radiochemistry. Progress report and review, 1984, 11:12277 (R;US)
Karrash, G., *See* Vagner, V., 11:11804
Karukstis, K.K., Effects of cation-induced and pH-induced membrane stacking on chlorophyll fluorescence decay kinetics, 11:11695 (J;NL)
Kassner, T.F., *See* Shack, W.J., 11:11231
Katahata, T., *See* Sato, N., 11:10838
Kataoka, T., *See* Kiga, T., 11:10880
Kathren, R.L., Introduction to the USUR data, 11:12001 (R;US)
Kato, K., Non-thermal electron velocity distribution measured by electron cyclotron emission in Alcator C tokamak, 11:12446 (R;US)
Kato, Y., *See* Nevins, D.J., 11:11929
Katona, E., *See* Zarand, P., 11:11826
Kaufman, F., Measurement of rate constants of elementary gas reactions of importance to upper atmosphere and combustion systems. Final technical report, 1 September 1980-28 February 1985, 11:11731 (R;US)
Kaune, W.T., *See* Frazier, M.E., 11:12025
Kaupp, A., Using agricultural waste in gas generators and its importance for developing countries, 11:11211 (RA;DE;In German)
Kaushal, S., *See* Roy, D.M., 11:11010
Kawai, Takahiro, Infrared finiteness in quantum electrodynamics, 11:12267 (BA;NL)
Kawalec, M., *See* Kuncicky, P., 11:11247
Kazmel, R., *See* Landry, G., 11:10845
Kearns, J.D., *See* Cook, D.A., 11:10890
Keck, R.L., Measurements of energetic electron distributions in uv and ir laser plasmas, 11:12486 (R;US)
Keeley, J.T., *See* Greene, E.F., 11:11667
Keen, N.T., Gene cloning as an approach to understanding specificity in plant-pathogen systems, 11:11964 (RA;US)
Kefa, C., Study on the ways of raising combustion efficiency and intensity of coal water slurry, 11:10873 (RA;US)
See Mingjiang, N., 11:10871
Keller, R.A., *See* Nogar, N.S., 11:11634
Kellogg, R., Experiment to measure nuclear double - β decay, 11:12149 (RA;US)
See Chang, C.Y., 11:11807
Kellogg, R.G., *See* Chang, C.Y., 11:12147
Kelly, H., *See* Hafemeister, D., 11:11450
Kelly, J.E., *See* Smith, R.C., 11:11352
Kelmers, A.D., *See* Boegly, W.J. Jr., 11:11027
Kelson, I., *See* Dombsky, M., 11:12344
Kempka, S.N., *See* Ratzel, A.C., 11:11740
Kenefick, R.A., *See* Palinkas, J., 11:12071
Kennedy, K.M., Results from a laboratory flow model for a UCG cavity, 11:10762 (RA;US)
Keough, R.F., Lithium purification technique, 11:12510 (P;US)
Kephart, J.O., *See* Berman, B.L., 11:11597
Kerbikov, B.O., Influence of quark configurations on the spectrum of the hadronic atom, 11:12085 (R;SU)
Keren, M., Demonstration and various test applications of COM in Israel, 11:10834 (RA;US)
Kerlin, R.C., *See* Crane, J.K., 11:12092
Kerr, W.C., *See* Bishop, A.R., 11:12088
Kessler, T.J., Holographic wavefront characterization of a frequency-tripled high-peak-power neodymium:glass laser, 11:11756 (R;US)
Kesson, T., Search for quark deconfinement: Strangeness production in pp, dd, pα, and $\alpha\alpha$ collisions at $\sqrt{s}$/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)
Ketchum, L.H. Jr., Anaerobic SBR treatment of coal conversion

wastewaters. First quarterly report, 11:10804 (R;US)
Keto, J.W., Kinetic studies following state selective laser excitation. Progress report, March 15, 1985-March 14, 1986, 11:12078 (R;US)
Ketterson, J. B., *See* Abraham, B. M., 11:11766
Kettle, S.F.A., *See* Liapis, K., 11:11676
Kevan, L., *See* Ohta, N., 11:11703
Khalmuradov, R.S., One-loop corrections to pion form factor in QCD in a light-like gauge, 11:12246 (R;SU)
Khan, M.A., *See* Starling, K.E., 11:11674
Khitrov, V.A., *See* Popov, Yu.P., 11:12335
Khomenko, B.A., *See* Bystritskij, V.M., 11:12087
Khovanskij, N.N., *See* Bystritskij, V.M., 11:12087
Kibler, M., Constraint quantization: case of the hydrogen atom, 11:12089 (R;FR;In French)
Kiga, T., Combustion technology of coal water mixtures, 11:10880 (RA;US)
Killeen, J., Plasma physics modeling and the Cray-2 multiprocessor, 11:12457 (R;US)
See Mirin, A.A., 11:12463
Killmeyer, R.P., Annotated bibliography of US government coal preparation publications, 1910-1984, 11:10859 (R;US)
Kilpatrick, M.P., WIDCO Partial Seam CRIP test: impact of gas characteristics on processing requirements, 11:10750 (RA;US)
Kim, D.C., *See* Kang, S.K., 11:10875
Kim, H., [Glass Development Laser (GDL) Facility upgrade.] LLE Review. Quarterly report, October-December 1984. Volume 21, 11:12487 (R;US)
[Laser energetics quarterly report, January-March 1985]. Volume 22, 11:12430 (R;US)
Kimel, E.A., *See* Bliss, C., 11:10892
Kimrey, H.D., *See* Bigelow, T.S., 11:12484
Kimura, N., *See* Nakabayashi, Y., 11:10837
See Wang, E., 11:11361
King, D.S., *See* Cavanagh, R.R., 11:11511
Kipker, R., *See* Truemper, H., 11:11472
Kirk, B.L., Integrated Tiger Series of electron/photon Monte Carlo transport codes: a user's guide for use on IBM mainframes, 11:12386 (R;US)
Kirk, H., *See* Chung, S.U., 11:12140
Kirk, P.N., Possible uses of the DLS dipoles in a search for the quark-gluon plasma at the AGS, 11:11814 (R;US)
Search for the formation of the quark-gluon plasma by measurement of cross sections for direct photons and leptons. Annual progress report, April 1, 1985-March 31, 1986, 11:12276 (R;US)
Kirmaier, C., *See* Gaspar, P.P., 11:11709
Kisgeci, J., *See* Pekic, B., 11:11143
Kishimoto, T., Quasifree production of hyperons from nuclei, 11:12359 (R;US)
Kispert, L.D., *See* Samskog, P.O., 11:11570
Kissinger, H.E., *See* Brimhall, J.L., 11:11539
Kiszenick, W., *See* Fairchild, R.G., 11:11981
Klein, R.K., *See* Berman, B.L., 11:11597
Klett, M.G., *See* Borden, M., 11:10861
Kletzien, R.F., Carcinogenic potential of products produced by coal conversion processes. Final technical report, 11:11966 (R;US)
Kleva, R.G., q = 2 sawteeth and major disruptions in tokamaks, 11:12462 (J;US)
Klingenberger, P., *See* Guntermann, K., 11:10760
Klinzing, G., *See* Ekmann, J., 11:10912
Klinzing, G.E., *See* Rohatgi, N.D., 11:10858
Klumov, I.A., *See* Bayukov, Yu.D., 11:11925
Kmetyk, L.N., TRAC-PF1/MOD1 independent assessment: LOBI large break transient A1-04R, 11:11330 (R;US)
Kmosena, J., In-service monitoring of reliability of V-1 nuclear power plant equipment, 11:11320 (RA;CS;In Slovak)
Knapp, F.F., *See* Dudczak, R., 11:11972
Knapp, J.A., Formation of surface layers of icosahedral Al(Mn), 11:11528 (R;US)
See Follstaedt, D.M., 11:11527
Knauth, L.P., Origin of fluid inclusion water in bedded salt deposits, Palo Duro Basin, Texas, 11:10998 (R;US)
Knight, T.D., TRAC-P1A independent assessment, 1979, 11:11326 (R;US)
Knize, M., *See* Taylor, R.T., 11:12011
Knoblauch, K., Utilization of non-mineable coal - a new approach of German coal industry, 11:10743 (RA;US)
Knoche, *See* Truemper, H., 11:11472
Knudsen, H., *See* Datz, S., 11:12107
Knudson, C.L., *See* Willson, W.G., 11:10740
Knystautas, R., *See* Nelson, L.S., 11:11349
Ko, C.M., *See* Aichelin, J., 11:12375
Koang, D.H., Indication of neutrino oscillation from the Bugey experiment, 11:12160 (R;FR)
Recent results from the Bugey neutrino oscillation experiment, 11:12159 (R;FR)
Kobayashi, T., *See* Tanihata, I., 11:12307
Koblinger, L., *See* Hofmann, W., 11:11993
See Petoe, A., 11:11830
Kobzarev, I., Interaction potential for three-particle hadronic systems in the large distance limit, 11:12196 (R;SU)
Kocher, D.C., *See* Boegly, W.J. Jr., 11:11027
Koehler, W.C., *See* Bates, F.S., 11:12135
Koehly, G., *See* Madic, C., 11:11115, 11:11607, 11:11613
Koenig, W., *See* Kanter, E.P., 11:12117
Koerner, W., *See* Zappe, D., 11:11035
Kogarko, S.M., Determination of flame propagation limits in stoichiometric oxyhydrogen mixtures with steam, 11:11738 (RA;XA)
Koh, I.G., *See* Bergshoeff, E., 11:12229
Koike, H., *See* Itoh, S., 11:11174
Kolachkovski, A., *See* Novgorodov, A.F., 11:11720
Kolaczkowski, A.M., Value impact assessment of standard review plan sections, 11:11347 (R;US)
Kolattukudy, P.E., Fungal penetration of defensive barriers of plants, 11:11933 (RA;US)
Kolesa, K., Information flow; a data bank preparation in nuclear power plant reliability information system, 11:11250 (RA;CS;In Czech)
Kolkunova, L.G., *See* Bayukov, Yu.D., 11:11925
Komaki, Y., *See* Sakurai, T., 11:11021
Kondratyuk, L.A., Tensor polarization of deuteron in πd and pd backward scattering and multiquark resonances, 11:12201 (R;SU)
Kong, H.S., *See* Edmond, J.A., 11:11555
Konieczny, S., *See* Gaspar, P.P., 11:11709
Konyukhova, N.B., *See* Badalyan, A.M., 11:12286
Koomey, J., *See* Levine, M.D., 11:11455
Kopac, J., CP violation with three generations of Majorana neutrinos, 11:12207 (R;CA)
See Picciotto, C., 11:12208
Kopstein, F.F., Maintenance Personnel Performance Simulation (MAPPS) model. Users' Manual, 11:11328 (R;US)
Korol'chenko, A.Ya., *See* Ivanov, A.V., 11:11735
See Shebeko, Yu.N., 11:11737
Korth, G.E., *See* Close, J.A., 11:11233
Kost, C.J., *See* Houtman, H., 11:12409
Kotschenreuther, M., Destabilization of MHD modes with finite Larmor radius effects in tandem mirrors, 11:12438 (R;US)
Koturovic, A.M., *See* Drndarevic, V.R., 11:11829
Kou, C., *See* Wang, Z., 11:10833
Kovacevic, K., *See* Novkovic, D., 11:11823
Kovalenko, S.S., *See* Kozulin, Eh.M., 11:12338
Kowalski, B.R., *See* Carey, W.P., 11:11629
Kox, S., Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
Kozulin, Eh.M., Fast neutron emission in interaction of 9 MeV/nucleon ^{13}C and ^{20}Ne ions with ^{181}Ta nuclei, 11:12338 (R;SU;In Russian)
Krajewski, R.F., *See* Andrews, J.W., 11:11412
Krakhauer, D.A., Elastic nu/sub e/ e scattering at LAMPF, 11:12150 (RA;US)
Kral, M., Life and reliability of water treatment equipment manufactured by CKD Dukla for fossil-fuel and nuclear power plants, 11:11246 (RA;CS;In Czech)
Kramer, S.D., *See* Hurst, G.S., 11:12172
Kraner, H.W., *See* Panessa-Warren, B.J., 11:11965
Krantz, W.B., *See* Britten, J.A., 11:10763
See Dautreame, B., 11:10764
See Tantekin, S.B., 11:10770
Krause, H.F., *See* Andrews, M.C., 11:12110, 11:12111
See Rosseel, T.M., 11:12115
Krauss, M., Application of quantum chemistry to atmospheric chemistry. Final report, 1 October 1983-30 September 1984, 11:11639 (R;US)
Kravis, S., *See* Mihara, Y., 11:11820
Krein, M.S., *See* Marshall, B.W. Jr., 11:11351
Krejzler, D., *See* Vagner, V., 11:11804
Kremnican, M., *See* Skvarka, P., 11:11252
Krier, H., Fundamentals of coal dust combustion: recommendations for

research on explosive limits of coal dust, 11:10897 (RA;US)
Kriewald, B., Micro-computer control VS 1000, 11:11441 (RA;DE;In German)
Krommes, J.A., Comments on "theory of dissipative density-gradient-driven turbulence in the tokamak edge" [Phys. Fluids 28, 1419 (1985)], 11:12450 (R;US)
Equilibrium fluctuation energy of gyrokinetic plasma, 11:12451 (R;US)
Kroner, W.M., RPI visitors center, 11:11191 (R;US)
Krug, N., *See* Steimle, F., 11:11382
Kruger, J., *See* Rote, D.M., 11:10997
Krumhansl, J.L., Observations regarding the stability of bentonite backfill in a high-level waste (HLW) repository in rock salt, 11:11585 (R;US)
Krumpelt, M., Fuel cell power plant designs: a review, 11:11408 (R;US)
Kruse, H., *See* Hill, J.C., 11:12283
See Kuever, M., 11:11423
See Quast, U., 11:11425
See Steimle, F., 11:11382
Kryter, R.C., Summary of studies on methods for detecting, locating, and characterizing metallic loose parts in nuclear reactor coolant systems, 11:11229 (R;US)
Kuang-i, C., *See* Kao-yu, H., 11:11767
Kubas, G.J., New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Kube, W.R., *See* Paulson, L.E., 11:10853
Kuever, M., Ways of optimizing refrigeration and deep-freeze equipment energy-wise, 11:11423 (RA;DE;In German)
Kugel, H.W., *See* Grisham, L.R., 11:12511
Kuhaneck, D.P., *See* Marciniak, T.J., 11:11446
Kuhn, A.K., Stress control technique: its history and suitability for WIPP, 11:11041 (R;US)
Kulcinski, G.L., Fusion reactor physics and technology studies. Final report, October 1, 1977-November 30, 1985, 11:12493 (R;US)
Kulkarni, S. V., Matched metal die compression molded structural random fiber fiber sheet molding compound flywheel, 11:11495 (P;US)
Kumar, C.V., Photophysical behaviors of N-methylthioacridone triplet and efficiency of singlet oxygen generation from its quenching by oxygen, 11:11707 (J;NL)
See Murty, B.A.R.C., 11:11706
Kunicky, P., Monitoring and assessment of reliability of power installations in Vitkovice Concern, 11:11247 (RA;CS;In Czech)
Kunori, S., D/sub phi/ experiment at TeV I, 11:12153 (RA;US)
See Steinberg, P., 11:12148
Kunz, A.B., Theoretical study of the binding of positrons of gaseous molecules, 11:12061 (R;US)
Kunz, J., *See* Durand, M., 11:12368
Kuraev, Eh.A., *See* Bel'kov, A.A., 11:12187
Kurth, M., *See* Patigny, J., 11:10745
Kusharin, A.Yu., *See* Kogarko, S.M., 11:11738
Kutschera, W., Half-life of ^{60}Fe, 11:11726 (J;NL)
Kuzmanoff, K.M., Identification of calmodulin released by osmotic shock of maize roots, 11:11971 (RA;US)
Kuzmin, V.A., Anomalous electroweak baryon number non-conservation in the early universe, 11:12183 (R;IT)
Kvandal, S.C., Development of design criteria for waste stabilization ponds in the Western Pacific Islands, 11:11481 (RA;PR)
Kwak, J.F., Magnetic order in the TMTSF family of organic superconductors, 11:11595 (J;GB)
See Beno, M.A., 11:11601
Kwinta, J., Preliminary separation of the lanthanide group using DHDECMP, 11:11604 (R;FR)
See Brossard, P., 11:11605
Kydes, A.S., SIMBID: An alternative, simplified model of bidding and awarding of new natural gas reserves, 11:10960 (R;US)
See Thode, H.C. Jr., 11:11398

L

L'hote, D., Do collective effects exist in the intra-nuclear cascade, 11:12316 (R;FR;In French)
La Poe, R.G., Sorption and desorption of volatile chlorinated aliphatic compounds by soils and soil components. Doctoral theses, 11:11914 (R;US)
LaBauve, R.J., Core neutronics code development and application, 11:11269 (RA;US)
Labavitch, J.M., *See* Greve, L.C., 11:11928
LaBounty, J.F., *See* Campbell, S.G., 11:11154
Labrie, R., *See* Slobodrian, R.J., 11:11803
Lachowicz, Y.V., *See* LaFlesh, R.C., 11:10877
Lackey, W.J., *See* Stinton, D.P., 11:11568
Lacombe, M., Nucleon-antinucleon resonance spectrum in a potential model, 11:12191 (R;FR)
See Vinh Mau, R., 11:12158
Ladisch, M.R., *See* Dale, M.C., 11:11139
Laermans, C., *See* de Goer, A.M., 11:11574
LaFlesh, R.C., Comparison of the performance of a cross-section of commercial CWF burners, 11:10877 (RA;US)
See Cook, D.A., 11:10890
Laget, J.M., Future prospects in photon and electron physics at Saclay, 11:12357 (R;FR)
Lake, J.A., Ultra high flux reactor design: probing the limits of plate fuel technology, 11:11283 (R;US)
Lambert, J.M., *See* Brown, R.E., 11:12289
Lambrecht, R., *See* Treves, S., 11:11717
Lamotte, B., Direct spectroscopic observation of molecular hydrogen by high resolution proton NMR and a reinterpretation of the proton NMR spectra for amorphous Si:H, 11:11575 (R;FR)
Lan, W.Z., *See* Shan, Z.Y., 11:12394
Lancman, H., High resolution photofission measurements in ^{238}U and ^{232}Th. Final report, 11:12350 (R;US)
See Zhang, H.X., 11:12349
Land, J.F., *See* Brynestad, J., 11:11565, 11:11658
Lande, K., *See* Cherry, M.L., 11:12174
Landis, D.A., *See* Goulding, F.S., 11:12325
Landis, E.R., *See* Bliss, C., 11:10892
Landry, G., Cape Breton Development Corporation's CARBOGEL coal water fuel project, 11:10845 (RA;US)
Landry, S.A., *See* Bamberger, C.E., 11:11564
Lane, D.L., *See* Allen, C.C., 11:11030
Langman, V.J., Experimental investigation of the rate of hydrogen absorption in zirconium-2.5 wt percent niobium from steam/hydrogen mixtures at elevated temperatures. Test specifications, 11:11649 (R;CA)
Langton, C.A., *See* Roy, D.M., 11:11010
Lanning, D.D., Trends in thermal calculations for light water reactor fuel (1971-1981), 11:11238 (R;US)
Use of fuel-thermocouple scram response for data verification, 11:11237 (R;US)
Lapicki, G., *See* Andrews, M.C., 11:12110, 11:12111
LaRiviere, P.D., Ionization rate measurements, 11:11852 (R;US)
Larsen, E.W., Discretization methods for one-dimensional Fokker-Planck operators, 11:12423 (J;US)
Larson, B.C., Pulsed-laser annealing effects in Si, 11:11599 (J;GB)
Larson, K.H., *See* LaRiviere, P.D., 11:11852
Larson, S.C., *See* Van Geem, M.G., 11:11448
Lashmore-Davies, C.N., *See* Hsu, J.Y., 11:12440
Laster, B.H., *See* Fairchild, R.G., 11:11981
Later, D.W., Products found in the anodic oxidation of coal, 11:11122 (J;GB)
Standardization of alumina and silica adsorbents used for chemical class separations of polycyclic aromatic compounds, 11:11632 (J;US)
See Camaioni, D.M., 11:10792
See Wright, C.W., 11:10927, 11:10928
Lau, I.T., Development of a bench-scale fluidized bed combustor for coal reactivity studies, 11:10913 (R;CA)
See Rowley, D.R., 11:10879
Lau, J.M., *See* Albersheim, P., 11:11951
Lauf, R.J., *See* Federer, J.I., 11:10805
See Stinton, D.P., 11:11568
Laughery, K.R. Jr., Nuclear power plant simulation facility evaluation methodology: handbook. Volume 1, 11:11266 (R;US)
Laune, B., Study of the dee-to-dee shielding, 11:11785 (RA;US)
Launspach, J., *See* Sauneuf, A., 11:12426
Lautner, R., Balance sheet of success for energy saving schemes in industry, 11:11437 (RA;DE;In German)
LaVopa, V., *See* Satterfield, C.N., 11:10781
Lawhon, J.T., *See* Sweeten, J.M., 11:11134
Lawler, J.S., *See* Detwiler, J.S., 11:11223
Layne, S., Problems associated with dimensional analysis of

electroencephalogram data, 11:11978 (R;US)
Layton, P.A., *See* Wright, L.L., 11:11163
Le Bouhellec, *See* Charvillat, 11:10987
Leach, D.D., *See* Vandenbosch, R., 11:12351
Leander, G.A., *See* Carter, H.K., 11:12067
Lebedeva, I.E., *See* Kabakchi, S.A., 11:11711
LeBlanc, B., *See* Ida, K., 11:12448
Leboeuf, J.N., *See* Sydora, R.D., 11:12437
LeCheminant, G.M., *See* Ruzicka, V., 11:10972
Ledbetter, D.M., *See* Martin, J.P., 11:11109
Ledent, P., What can be learned from linking tests at great depth?, 11:10775 (RA;US)
Lee, C.K., *See* Cherry, M.L., 11:12174
Lee, D.J., Elasto-plastic creep analysis of an exisymmetric shell subject to pure thermal loading, 11:11744 (R;GB)
Lee, E.H., Effects of rapidly pulsed ion bombardment on microstructure and phase stability in a Ti-modified stainless steel, 11:11509 (R;US)
Lee, G.S., *See* Sydora, R.D., 11:12437
Lee, H., *See* LaRiviere, P.D., 11:11852
Lee, H.K., *See* Walkowiak, W., 11:11627
Lee, I.Y., *See* Fewell, M.P., 11:12120
Lee, J.H., *See* Nelson, L.S., 11:11349
Lee, J.K., *See* Advani, S.H., 11:10773
See Avasthi, J.M., 11:10772
See Kang, S.K., 11:10875
Lee, L.L., *See* Starling, K.E., 11:11674
Lee, M.H., *See* Hong, J., 11:12418
Lee, M.I., *See* Later, D.W., 11:11632
Lee, R., *See* Jones, D.W., 11:10918
Lee, S.Y., *See* Boegly, W.J. Jr., 11:11027
Lee, T.N., *See* Blanton, J.O., 11:11913
Lee, W.P., *See* Allen, R.C., 11:12168
Lee, W.W., *See* Krommes, J.A., 11:12451
Lee, Y.C., *See* Liu, C.S., 11:12466
Lefcourt, M., Ionic dissociation of hydroxycyclohexadienyl radical: effect on ^{13}C hyperfine splittings, 11:11692 (J;US)
Lefevre, M.E., Retention of ingested latex particles in Peyer's patches of germ-free and conventional mice, 11:12010 (J;US)
LeGalley, R.R., Design of a low-noise fiber-optic transmitter module, 11:11774 (R;US)
Legare, M., SO(4) Reduction of the SU(N) Yang—Mills—Dirac equations, 11:12258 (J;US)
Legeled, M.A., Characterization of high-fired PuO_2 as a certified reference material, 11:11097 (J;US)
Lehman, D.R., *See* Gibson, B.F., 11:12292
Lehto, J., Sodium titanate. A highly selective inorganic ion exchanger for strontium, 11:11020 (RA;XA)
Leitch, M.J., *See* Baer, H.W., 11:12281
Leland, H.V., Heavy metals and other trace elements, 11:11917 (J;US)
Lemmon, R.M., *See* Powell, M.F., 11:11693
Lepel, E.A., *See* Olsen, K.B., 11:10969
Leray, S., Linear momentum transfer in the $^{40}Ar + {}^{238}U$ system for projectile energies from 20 to 44 MeV/u, 11:12348 (R;FR)
Lessi, J., *See* Gadelle, C., 11:10747
Lesyng, B., *See* Saenger, W., 11:11946
Levasseur, A.A., *See* Hargrove, M.J., 11:10893
See LaFlesh, R.C., 11:10877
Lever, A.B.P., *See* Dodsworth, E.S., 11:11638
Levermore, C.D., *See* Larsen, E.W., 11:12423
Leverton, P.A., Numerical estimate of nucleon form factors up to momentum transfer squared q^2 approx. 200 GeV^2/c^2, 11:12209 (R;AU)
Levi, B., *See* Hafemeister, D., 11:11450
Levine, L.H., *See* Alexander, C., 11:12051
Levine, M.D., Economics of efficiency improvements in residential appliances and space conditioning equipment, 11:11455 (J;US)
Levine, S.H., Pennsylvania State University Breazeale Nuclear Reactor. Thirtieth annual progress report, July 1, 1984-June 30, 1985, 11:11281 (R;US)
Levinthal, C., *See* Dimmler, D.G., 11:12519
Levy, G.W., *See* Morgenstern, M.H., 11:11327
Levy, R.D., Value-based utility planning: scoping study. Final report, 11:11401 (R;US)
Lewis, L.N., *See* Sexton, R., 11:11955
Lewis, M.B., *See* Lee, E.H., 11:11509
Lewis, P.M., *See* Poletti, A.R., 11:12341
Li, C.Y., Summary of recent research on mechanical behavior of polycrystalline solids. Progress report, March 1985-March 1986, 11:11512 (R;US)
Li, F.Y., *See* Guo, C.T., 11:10830
Li, G.F., *See* Shan, Z.Y., 11:12394
Li, J.C.M., *See* Chaki, T.K., 11:11548
Li, S.F., *See* Guo, C.T., 11:10830
Li, T.K., *See* Patigny, J., 11:10745
Liao, C.L., Fine structure effect on the charge transfer reaction of $Ar^+(^2P_3/$ sub //$_2$/sub ,/$_1$/sub //$_2$)+N_2 (X $^1\Sigma^+/$ sub g/ ,v = 0), 11:12099 (J;US)
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
Liapis, K., Solid state studies. 29. Crystalline urea: evidence for vibrational delocalization, 11:11676 (J;US)
Libby, L.M., *See* Alexander, C., 11:12051
Liboa, P., *See* Vinh Mau, R., 11:12158
Licastro, P.H., *See* Roy, D.M., 11:11010
Liebenthal, J.L., *See* Lake, J.A., 11:11283
Lieberman, M.L., Chemistry of (5-cyanotetrazolato-N^2)pentaamminecobalt(III) perchlorate and similar explosive coordination compounds, 11:11851 (J;US)
Liebetrau, A.M., *See* Apted, M.J., 11:11066
See Goldman, A.S., 11:11100
Lignacchi, S., *See* Michele, G.D., 11:10874
Lignori Neto, R., *See* Carlin Filho, N., 11:12299
Likhoded, A.K., *See* Gershtejn, S.S., 11:12188
Lim, W.Y., *See* Motley, E.P., 11:10795
Lin, S.H., *See* Hsu, J.Y., 11:12458
Linak, W.P., Aerosol formation from pulverized coal combustion. Quarterly report No. 7, 11:10906 (R;US)
Aerosol formation from pulverized coal combustion. Quarterly report No. 8, 11:10907 (R;US)
Aerosol formation from pulverized coal combustion. Quarterly report No. 9, 11:11734 (R;US)
Lindborg, A., Screw compressors in the food industry, 11:11464 (RA;DE;In German)
Lindley, P.A., *See* Davis, B.E., 11:10916
Lindsay, R.W., Potential safety enhancements to nuclear plant control: Proof testing at EBR-II, 11:11277 (BA;US)
Lindsten, D.C., Radiological water decontamination study, 11:11918 (R;US)
Lindstrom, P., *See* Gould, H., 11:12116
Linnig, D.A., Coal slurry production costs, 11:10915 (RA;US)
Lippert, T.E., Ceramic filter elements for high-pressure, high-temperature gases, 11:11222 (R;US)
Listak, J.M., *See* Organiscak, J.A., 11:10924
Litman, G., Biochemical studies on the mechanism of benzo(a)pyrene binding to cellular macromolecules. Progress report, 11:12007 (R;US)
Littlejohn, D., Determination of nitrogen-sulfur compounds by ion chromatography, 11:11628 (J;US)
Liu, C.S., Inductance effect of runaways on lower-hybrid-current ramping, 11:12466 (J;US)
See Hsu, J.Y., 11:12458
Liu, D., Calculated ν_2 (inversion) spectrum of H_3O^+, 11:12097 (J;US)
Liu, E.H., *See* Causilla, H., 11:10835
Liu, J., Electromagnetic solitary vortices in rotating plasma, 11:12435 (R;US)
Liu, J.T., *See* Baltay, C., 11:12166
Liu, K., *See* Hall, G., 11:12098
Liu Liang, *See* Wang Yuzhu, 11:12083
Llobet, X., *See* Berk, H.L., 11:12436
Lo, S.Y., *See* Leverton, P.A., 11:12209
Locklin, D.W., *See* Razgaitis, R., 11:11413
Lockwood, W.R., *See* Mortazavi, H.R., 11:10771
Loehman, R.E., *See* Mecartney, M.L., 11:11560
Loginov, S.I., *See* Glebov, I.A., 11:11271
Loiseau, B., Off-shell properties of the Paris nucleon-nucleon potential and implications for few-body systems, 11:12193 (R;FR)
Spin dependent NN and N anti N interaction from the Paris potential, 11:12157 (R;FR)
See Lacombe, M., 11:12191
See Vinh Mau, R., 11:12158
Lokan, K.H., Residual radioactive contamination at Maralinga and Emu, 1985, 11:11898 (R;AU)
Lokken, R.O., *See* Strachan, D.M., 11:11060
Loios, G.J., *See* Ziegler, W., 11:12305
Lomdahl, P.S., *See* Bishop, A.R., 11:12088
LoMonte, A.F., *See* Glaros, D., 11:11980
Long, M.B., *See* Chang, R.K., 11:11732, 11:12128
Longenecker, J.R., A new era in U.S. uranium enrichment, 11:10981 (J;US)
Longequene, N., *See* Kox, S., 11:12302
Loo, B.W., New Compton densitometer for measuring pulmonary edema, 11:11979 (R;US)
Looney, J.H., Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly

technical progress report, January-March 1985, 11:10854 (R;US)
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, July-September 1985, 11:10855 (R;US)
Lopes, J.L., *See* Fleury, N., 11:12179, 11:12186
Lopez-Romero, E., Sterol composition of chitosomes from Mucor rouxii, comparison with whole cells, 11:11942 (RA;US)
Lorenz, A., Coordination of the international network of nuclear structure and decay data evaluators. Summary report of a consultants' meeting organized by the IAEA and held at the Fachinformationszentrum in Karlsruhe, FRG, 3-6 April 1984, 11:12278 (R;XA)
Report of the Nuclear Data Section to the International Nuclear Data Committee March 1983 - August 1984, 11:12270 (R;XA)
Lougheed, R.W., *See* Maguire, H.T., 11:12355
Loving, B.A., *See* Shackelford, S.A., 11:11694
Low, J.O., Annual technology assessment and progress report for the Buried Transuranic Waste Program at the Idaho National Engineering Laboratory, 11:11012 (R;US)
Long-range plan for buried transuranic waste studies at the Idaho National Engineering Laboratory, 11:11011 (R;US)
Lowe, T.C., *See* Asaro, R.J., 11:11529
Lower, C.W., *See* Gessiness, B., 11:11099
Lowndes, D.H., *See* Jellison, G.E. Jr., 11:11576
Lu, D., *See* Xie, M., 11:10889
Luban, M., New Schroedinger equations for old: Inequivalence of the Darboux and Abraham-Moses constructions, 11:12415 (J;US)
Lucke, R.B., *See* Wright, C.W., 11:10927, 11:10928
Lucot, M., "OPERA" loop in the OSIRIS reactor core. Pressurized water irradiation device for the study of advanced reactor fuels, 11:11286 (R;FR;In French)
Ludewig, H., Mechanistic determination of fission product releases for a Mark III BWR plant, 11:11297 (R;US)
See Shiu, K.K., 11:11293
Lue, J.W., Superconducting magnet research and development program, 11:12483 (R;US)
Luebeck, E.G., *See* Wilets, L., 11:12225
Luecke, W., *See* Grimm, W., 11:11189
Luhmann N.C. Jr., *See* Brower, D.L., 11:12465
Lui, Y.W., *See* Sullivan, J.P., 11:11819
Luke, O.N., *See* Goulding, F.S., 11:12325
Lundy, T.S., BTESM National Program: past, present, and future, 11:11418 (R;US)
Lunsford, J.H., *See* Driscoll, D.J., 11:11675
Luthy, R.G., Research on wastewater treatment and reuse for coal gasification and liquefaction, 11:10738 (RA;US)
Lutz, K., Development of simple air collectors for drying agricultural produce in developing countries, 11:11197 (RA;DE;In German)
Luxmoore, R.J., *See* Shriner, D.S., 11:12009
Lyamin, A.G., *See* Kogarko, S.M., 11:11738
Lynch, J.F., *See* Reilly, J.J., 11:11567
Lynn, K.G., Description of the intense, low energy, monoenergetic positron beam at Brookhaven, 11:11114 (R;US)
Lyon, J.L., *See* Nothnagel, E.A., 11:11943
Lyuboshitz, V.L., Effective cross section matrix and the isotopic relations between the structure functions of inclusive processes, 11:12204 (R;SU;In Russian)

M

Ma, R.X., *See* Wang, Y.S., 11:10882
Ma, X., *See* Kutschera, W., 11:11726
Macchiavelli, A.O., Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
Macdonald, B.C., *See* Reiter, E.R., 11:11908
Macdonald, D.D., *See* Rote, D.M., 11:10997
MacFarlane, R.E., *See* LaBauve, R.J., 11:11269
MacGowan, B.J., *See* Burkhalter, P.G., 11:11760
Machen, D.R., *See* Nelson, R.O., 11:12387
Mackenzie, P.B., Evidence against a stable dibaryon from lattice QCD, 11:12214 (J;US)
MacKinnon, R.J., Modeling of 2-D cavity growth using continuously deforming finite elements, 11:10774 (RA;US)
Macklin, R.L., Resonance neutron capture by manganese below 2.5 keV, 11:12322 (J;US)
Maclachlan, G., *See* Hayashi, T., 11:11970
MacVittie, T.J., *See* Brook, I., 11:11990
See Gruber, D.F., 11:11989
Madden, K., *See* Geiger, D.K., 11:11682
Madden, K.P., *See* Lefcourt, M., 11:11692
Madden, N.W., *See* Goulding, F.S., 11:12325
Madey, R., *See* Huang, J.C., 11:11665
Madic, C., Preparation of isotopes and sources of actinide elements, 11:11115 (R;FR)
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinides elements, 11:11607 (R;FR)
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinide elements, 11:11613 (RA;XA)
Maessen, B., Variational calculations of rotational-vibrational energy levels of formaldehyde X $^1A_1$, 11:11681 (J;US)
Magan, D.L., *See* Curlee, R.M., 11:11089
Magee, J.L., *See* Wright, H.A., 11:12389
Magill, J., *See* Ohse, R.W., 11:11538
Magnani, N.J., Exploratory Battery Technology Development and Testing report for 1984, 11:11372 (R;US)
Maguire, H.T., Neutron-induced fission cross-section measurements of ^{244}Cm, ^{246}Cm, and ^{248}Cm, 11:12355 (J;US)
Mahajan, S., Mechanism for baryogenesis in supersymmetric inflationary cosmologies, 11:12044 (J;US)
See Riyopoulos, S., 11:12433
Mahler, H.I., *See* Chen, H.H., 11:11845
Mahler, H.J., *See* Allen, R.C., 11:12168
Mahlum, D.D., *See* Wright, C.W., 11:10927, 11:10928
Mahran, M.H., *See* Obada, A.S.F., 11:12082
Mai, M., *See* Park, K.Y., 11:10767
Maier-Komor, P., *See* Drumm, P.V., 11:12311
Mallen, J.C., *See* Toth, L.M., 11:10988
Maimoni, A., Aluminum-Air Power Cell: the M4-cell assembly and initial tests, 11:11373 (R;US)
Maiya, P.S., *See* Shack, W.J., 11:11231
Majka, Z., Microchannel plate zero time detector, 11:11818 (RA;US)
Malbouisson, A.P.C., Does QCD have infrared renormalons, 11:12222 (R;BR)
Malicki, N., *See* Dooher, J.P., 11:10796
Maljaars, A.P.E., *See* Ronde, H., 11:10754
Mallon, R.G., Operating experience with the Livermore solid-recycle retort system, 11:10970 (R;US)
Malone, D.F., *See* Goulding, F.S., 11:12325
Malta, C.P., *See* Perez, J.F., 11:12407
Malte, P.C., Combustion and pollutant-forming characteristics of low-rank western coals, 11:10899 (RA;US)
Mandler, J.W., *See* Proctor, A.E., 11:11108
Mangeng, C.A., *See* Altseimer, J.H., 11:11410
Mangold, B.L., *See* Dean, D.A., 11:11987
Manickam, J., Accessibility of second regions of stability in tokamaks, 11:12454 (R;US)
Mann, A.K., *See* Fowler, W.A., 11:12177
Mann, D.C., *See* Bean, R.M., 11:11255
Mannan, M., *See* Starling, K.E., 11:11674
Manogue, W., *See* Bischoff, K.B., 11:11141
Mansur, L.K., *See* Hayns, M.R., 11:11510
See Lee, E.H., 11:11509
Marasigan, M.M., *See* Eustis, R.H., 11:11483
March, N.H., *See* Roman, E., 11:11519
Marciniak, T.J., Heat exchanger requirements for potable water protection. Final report, 11:11446 (R;US)
Marcouiller, B.A., Geotechnical studies on the overburden rock from the Hanna IV UCG site, 11:10751 (RA;US)
Marcy, A.D., *See* Allen, C.C., 11:11030
Mardis, H.M., *See* Petko, C., 11:11883
See Petko, C.M., 11:11885
Mardis, M., Environmental Radiation Data report 28: October-December 1981, 11:11884 (R;US)
Margulies, A.E., *See* Haider, G., 11:10885
Marianowski, L.G., *See* Petri, R.J., 11:11360
Markel, K.E. Jr., Hot gas cleanup for pressurized fluidized bed combustion burning low rank coal, 11:10903 (RA;US)
Markel, L.C., *See* Detwiler, J.S., 11:11223
Markin, J.T., Design and evaluation of an integrated safeguards system: principles, 11:11092 (J;US)
Markovic, P., *See* Smelcerovic, M., 11:11832

Marotta, F.J., *See* Mazour, T.J., 11:11334
Marques, G.C., *See* Bertolami Neto, O., 11:12040
See Carvalho, C.A. de, 11:12237
See Eboli, O.J.P., 11:12236
Marrast, J., *See* Gadelle, C., 11:10747
Marsala, J., *See* Murphy, K., 11:11447
Marsden, P.F., *See* Delmer, D.P., 11:11927
Marshall, B.W. Jr., Recent intermediate-scale experiments on fuel-coolant interactions in an open geometry (EXO-FITS), 11:11351 (R;US)
Marshall, E., *See* Cherry, M.L., 11:12174
Marshall, J.L., *See* Neyhart, G.A., 11:11175
Martemyanov, B., *See* Kobzarev, I., 11:12196
Martin, G.D., *See* Grisham, L.R., 11:12511
Martin, J.P., Maintenance and the upgraded security system, 11:11109 (J;US)
Martinez, D.R., Combined experimental/analytical modeling of shell/payload structures, 11:11742 (R;US)
Martinez, J., *See* Fehlau, P.E., 11:11840
Martinez, M.J., *See* Dawson, P.R., 11:12035
Martinis, J.M., Signal and noise theory for a dc SQUID amplifier, 11:11750 (J;US)
Martins, M.N., *See* Wolynec, E., 11:12334
Martonen, T.B., Surrogate experimental models for studying particle deposition in the human respiratory tract, 11:11871 (R;US)
Mashburn, D.N., *See* Jellison, G.E. Jr., 11:11576
Maskarinec, M.P., Batch and column extraction procedures for organics in solid wastes, 11:11480 (J;US)
Mobility of organic and inorganic constituents from energy and combustion-related wastes under codisposal conditions, 11:11484 (J;US)
Mason, S., *See* Saenger, W., 11:11946
Massey, M.J., *See* Gray, R.H., 11:10793
Masson, M., *See* Roth, E., 11:12474
Masuda, Y., *See* Yamamoto, R., 11:11932
Mateja, J.F., Research in nuclear physics. Progress report, April 1, 1985-March 31, 1986, 11:12297 (R;US)
Mathelitsch, L., *See* Loiseau, B., 11:12193
Mathur, M., *See* Ekmann, J., 11:10912
Matsuda, Y., *See* Rognlien, T.D., 11:12456
Matthews, D.L., *See* Burkhalter, P.G., 11:11760
Matthews, J.G., *See* Pellet, S., 11:11988
Matthews, T.G., Formaldehyde emissions from fibrous glass insulation products, 11:11865 (R;US)
Modeling and testing of formaldehyde emission characteristics of pressed-wood products. Reports XII, XIII, and XIV to the US Consumer Product Safety Commission, 1985, 11:11868 (R;US)
Maupin, E.H., Natural Gas Annual 1984. Volume II, 11:10963 (R;US)
Maurer, R.J., *See* Palinkas, J., 11:12073
Maurice, C., *See* Guillaume, B., 11:10984
Mausner, L.F., *See* Kutschera, W., 11:11726
Maxfield, S.J., *See* Chang, C.Y., 11:12147
May, M., Hypernuclear gamma rays, 11:12036 (R;US)
Mayer, R.L., Measurement control assessment of radiometric calorimeters using nonstandards based indicators, 11:11096 (J;US)
Mayer-Kress, G., *See* Holzfuss, J., 11:12421
See Layne, S., 11:11978
See Umberger, D.K., 11:12420
Maynard, C.W., *See* Kulcinski, G.L., 11:12493
Maziasz, P.J., Effects of helium content of microstructural development in Type 316 stainless steel under neutron irradiation, 11:11525 (R;US)
Perspective on present and future alloy development efforts on austenitic stainless steels for fusion application, 11:11507 (R;US)
Mazour, T.J., Instructional skills evaluation in nuclear industry training, 11:11391 (R;US)
Management perceptions of the Health Physics Technician job, 11:11334 (R;US)
Mazurkiewicz, M., Use of high pressure water jets as a high efficiency tool for coal comminution, 11:10832 (RA;US)
McAuliffe, M.J., *See* Hall, G., 11:12098
McCarthy, I.E., *See* Mitroy, J., 11:12081
McCarthy, J., *See* Minehart, R.C., 11:12293
McCauley, E.W., *See* Bowman, B.R., 11:11354
McClain, C.R., *See* Blanton, J.O., 11:11913
McConathy, R.K., *See* Shriner, D.S., 11:12009
McConnell, J.W. Jr., Low level waste data base development - EPICOR-II resin/liner investigation. Program review, 11:11013 (R;US)
McCormick, R.L., *See* Haynes, H.W. Jr., 11:10785
McCright, R.D., *See* Oversby, V.M., 11:11069
McCue, P.M., Hematologic values of the endangered San Joaquin kit fox, Vulpes macrotis mutica, 11:10937 (R;US)
McCulla, W.H., *See* Bostick, W.D., 11:11070
McDaniel, F.D., *See* Andrews, M.C., 11:12110, 11:12111
McDonald, C.F., Small modular HTGR nuclear power plant concept to meet the total energy needs of the developing nations, 11:11257 (R;US)
McDonald, R.J., *See* Andrews, J.W., 11:11412
See Morrissey, D.J., 11:12346
McGowan, F.K., *See* Fewell, M.P., 11:12120
McGowan, T.F., *See* Curtis, G.B. Jr., 11:11149
McGowin, C.R., Technical and economic aspects of a lignite-fired AFBC boiler, 11:10901 (RA;US)
McGrail, B.P., Initial results for the experimental evaluation of a nuclear waste repository source term model, 11:11048 (J;US)
McGuire, J.M., *See* Shackelford, W.M., 11:11915
McHargue, C. J., Method for producing hard-surfaced tools and machine components, 11:11541 (P;US)
McHargue, C.J., *See* Oliver, W.C., 11:11556
See White, C.W., 11:11563
McIntosh, W.H., Environmental assessment of repository sites considerations and methodology, 11:11071 (J;US)
McIntyre, J.M., *See* Detwiler, J.S., 11:11223
McKinley, I.G., Quantification of source-term profiles from near-field geochemical models, 11:11065 (RA;US)
McKinley, K.F., *See* Detwiler, J.S., 11:11223
McKinsey, R.R., Underground coal gasification commercialization concepts, 11:10756 (RA;US)
McKone, T.E., Consideration of resource privation by severe reactor accidents, 11:11356 (J;US)
McLarnon, F.R., *See* Flatt, J.H., 11:11699
McLaughlin, S.B., *See* Shriner, D.S., 11:12009
McLean, J.B., *See* Barclay, R. Jr., 11:10789
McMahon, J., *See* Levine, M.D., 11:11455
McMahon, P., Economics of Australian uranium mining, 11:10993 (R;XA)
McMillian, D.E., *See* Nelson, R.O., 11:12387
McMullan, R.K., *See* Didisheim, J.J., 11:11573
McNair, M.B., Coal distribution, January-September 1985, 11:10815 (R;US)
McNaughton, M.W., *See* Bonner, B.E., 11:12171
McNeil, M., *See* York, W.S., 11:11945
McNeill, D.H., Power balance in ELMO Bumpy Torus: bulk electrons and ions in a 37 kW discharge, 11:12447 (R;US)
McNerney, G.M., *See* Sons, R.J., 11:11104
McNerney, R.M., *See* Workhoven, R.M., 11:11103
McParland, B., *See* Ziegler, W., 11:12305
McParland, B.J., Angular dependence of the sup(6)Li(πsup(+), sup(3)He)sup(3)He reaction, 11:12304 (R;CA)
McRae, T. G., *See* Bianchini, G. M., 11:10966
McTernan, E.M., Techniques used in the determination of the areal extent of organic contamination at the US DOE Hoe Creek underground gasification site, 11:10808 (RA;US)
McVay, G.L., *See* McGrail, B.P., 11:11048
See Weber, W.J., 11:11046
McWhorter, P.J., Simple technique for separating the effects of interface traps and trapped-oxide charge in metal-oxide-semiconductor transistors, 11:11778 (J;US)
Mead, G.A., *See* Schubert, J.F., 11:11864
Meadows, G.E., *See* Keough, R.F., 11:12510
Mecartney, M.L., Silicon nitride joining, 11:11560 (J;US)
Medeiros e Silva Filho, J., *See* Bascia, B., 11:12093
Medley, S.S., *See* Cecil, F.E., 11:12291
Medveczky, L., Present status of neutron detection in ATOMKI, 11:11831 (RA;AT)
Megy, J., French experience and prospects in the reprocessing of fast breeder reactor fuels, 11:10985 (R;FR;In French)
Spent fuel reprocessing past experience and future prospects, 11:10986 (R;FR;In French)

Mehnert, R., *See* Schmidt, J., 11:11713, 11:11714
Mehta, R., *See* Andrews, M.C., 11:12110, 11:12111
Meier, W.R., Neutron activation in Cascade: the BeO/$LiAlO_3$ case, 11:12507 (R;US)
Meikrantz, D.H., *See* Gupta, V.P., 11:12329
Meinhold, A., *See* Kaplan, E., 11:12028
Meininger, R.D., Passive surveillance: a technique to characterize the condition of power and control circuits in a nuclear plant, 11:11304 (R;US)
Meinken, G. E., *See* Srivastava, S. C., 11:11982
Meiss, J.D., Markov-Tree model of intrinsic transport in Hamiltonian systems, 11:12416 (J;US)
Mele, E.J., *See* Alerhand, O.L., 11:11591
Melius, C.F., *See* Ho, P., 11:11653
Melo, A., *See* Skotheim, T.A., 11:11701
Mendis, M.S., *See* Sabadell, A.J., 11:11148
Menet, J., *See* Kox, S., 11:12302
Menezes Franca, H. de, Forced harmonic oscillator with damping and thermal effects, 11:12405 (R;BR)
Menjoz, A., Identification of the response parameters of a geothermal field during a non-isothermal short time water injection test, 11:11202 (R;FR;In French)
Menon, M.M., *See* Tsai, C.C., 11:12479
Mensel, D.W., *See* Blanton, J.O., 11:11913
Menzel, D.W., Coordination: Southeast continental shelf studies. Progress report, 1 June 1984-31 December 1985, 11:12034 (R;US)
Menzen, G., *See* Wolf, A., 11:12327
Mercer, R.B., *See* Spane, F.A. Jr., 11:12030
Merker, G.P., *See* Steimle, F., 11:11382
Meron, M., Investigations of molecular orbitals with accel-decel beams, 11:12104 (J;NL)
See Johnson, B.M., 11:12112
See Schmidt-Boecking, H., 11:12105
Merts, A.L., *See* Collins, L.A., 11:12384
Mesmer, R.E., *See* Simonson, J.M., 11:11660
Metraux, J.P., *See* Richmond, P.A., 11:11961
Metz, P.D., Performance results from the Hydrogen Technology Evaluation Center at Brookhaven National Laboratory, 11:11119 (R;US)
Photovoltaic-powered solid polymer electrolyte (SPE) electrolyzer system evaluation. Final report, 11:11120 (R;US)
Metzger, G., *See* Kwinta, J., 11:11604
Meunier, F., *See* Dupont, M., 11:11181
Meuser, R., *See* Taylor, C.E., 11:11805
Meyer, H.O., *See* Brown, R.E., 11:12289
Meyer, P.L., Photographic and Malvern analysis of coal-water slurry atomization, 11:10866 (RA;US)
Meyer, R.A., Deformation and shape coexistence in medium mass nuclei, 11:12332 (J;NL)
Meyer, T.J., *See* Allen, G.H., 11:11176
See Caspar, J.V., 11:11668
See Neyhart, G.A., 11:11175
See Sullivan, B.P., 11:11669
Meyers, R.A., *See* Motley, E.P., 11:10795
Mialocq, J.C., Recent picosecond spectroscopy studies of photoactivated electron transfer reactions in solution, 11:11157 (R;FR)
Micca, P.L., *See* Fairchild, R.G., 11:11981
Michalowicz, J.V., Calculation of lower confidence bounds on system reliability, 11:11855 (R;US)
Michalski, T.J., *See* Gast, P., 11:11705
Michele, G.D., Combustion characteristics of coal and pet-coke water mixtures, 11:10874 (RA;US)
Mielke, E.W., Analogue of the Witten effect in the Poincare gauge theory of gravity, 11:12231 (R;IT)
Miemiec, L.S., *See* Hargrove, M.J., 11:10893
Miettinen, J.K., *See* Lehto, J., 11:11020
Mihara, Y., Parity violation in ^{3}H (vector p/sub e/, p) H scattering, 11:11820 (RA;US)
See Gagliardi, C.A., 11:11787
Mikhail, E.M., *See* Misak, N.Z., 11:11612
Mikhajlov, S.V., Evolution kernels in QCD: two-loop calculation in the Feynman gauge, 11:12249 (R;SU;In Russian)
Mikus, M., *See* Hrazsky, M., 11:11251
Miljanic, S., *See* Dvornik, I., 11:11827
Miller, A.K., *See* Martinez, D.R., 11:11742
Miller, D., *See* Rosen, J., 11:12145
Miller, F.C., Large-scale electrolytic reduction of U(VI) to U(IV), 11:10978 (R;CA)
Miller, G., *See* Uziel, M., 11:11678
Miller, G.A., Quarks and nuclear properties, 11:12362 (R;US)
Miller, J.R., Impact of several reactor features on TF coil design for TPSS, 11:12503 (R;US)
Miller, M.R., *See* Kletzien, R.F., 11:11966
Miller, P.D., Excited state populations and charge-exchange of fast ions in solids, 11:12118 (J;NL)
See Andrews, M.C., 11:12110, 11:12111
Miller, T., *See* Hsieh, T.C., 11:11537
Mills, A.P. Jr., *See* Lynn, K.G., 11:11114
Mills, B., Combustion trials on coal water slurry and petroleum coke water slurry, 11:10872 (RA;US)
Mills, G.A., *See* Bischoff, K.B., 11:11141
Mills, J.M., *See* Scheimer, J.F., 11:12032
Minard, P., *See* Stek, M., 11:11992
Minasi, M.J., Modeling residential natural gas demand at the state level, 11:10959 (R;US)
Minehart, R.C., Quasi-free scattering of π^+ and π from ^{3}He and ^{4}He at energies from 350 to 475 MeV, 11:12293 (BA;NL)
Minghu, X., *See* Kefa, C., 11:10873
Mingjiang, N., Agglomeration, evaporation and devolatilization of coal water mixture, 11:10871 (RA;US)
Minkov, V., *See* Krumpelt, M., 11:11408
Minton, L.A., *See* Wagner, D.P., 11:11313
Miranda, J.E., *See* Timm, R.E., 11:11102
Miric, I., Neutron dose distribution in a water phantom irradiated with 14 MeV neutrons, 11:12391 (RA;AT)
Miric, P., *See* Novkovic, D., 11:11823
Mirin, A.A., Linear studies of resistive interchange modes in a cylindrical reversed field pinch, 11:12463 (J;US)
Mirk, K., *See* Taylor, C.E., 11:11805
Misak, N.Z., Ion exchange characteristics of hydrous oxides and their use in the separation of uranium and thorium, 11:11612 (RA;XA)
Mitchell, D.E., *See* Corradini, M.L., 11:11344, 11:11348
Mitchell, H.G., *See* Ganguli, S.G., 11:12054
Mitra, S., *See* Azarm, M.A., 11:11336
Mitroy, J., Method for solving the Lippmann-Schwinger equation. I. Single channel case, 11:12081 (R;AU)
Miyamae, S., *See* Kiga, T., 11:10880
Miyano, K., *See* Abraham, B. M., 11:11766
Miyao, Y., *See* Wolynec, E., 11:12334
Miyoshi, D.S., Supporting the material control and accountancy system with physical protection system features, 11:11093 (J;US)
Mizumoto, M., *See* Murata, T., 11:12279
Mizuno, K., Electron heating caused by parametrically driven turbulence near the critical density, 11:12509 (J;US)
Moak, C.D., *See* Miller, P.D., 11:12118
Moeller, D.W., *See* Evans, J.S., 11:11997
Moere, H., Radioactive substances in building materials. A compilation of results from samples examined at SSI, 11:12392 (R;SE;In Swedish)
Mohamed, Z.E., *See* Obada, A.S.F., 11:12082
Mohapatra, N., *See* Nesnow, S., 11:11870
Mohr, D., *See* Planchon, H.P., 11:11299
Mok, W.M., Extraction of arsenic(III) and arsenic(V) from natural waters for neutron activation analysis, 11:11626 (J;US)
Molen, R.V., Fluid bed combustion bed properties with LRC, 11:10902 (RA;US)
Molini, A.E., Bamboo as a renewable energy source, 11:11159 (RA;PR)
Molitoris, J.J., *See* Cusson, R.Y., 11:12306
Moll, A.J., UCG - derived synthesis gas: an economic comparison, 11:10758 (RA;US)
Molla-Djafari, H., Investigation of trace elements in domestic coal and its combustion products, as well as in industrial samples and ashes of special refuse by means of neutron activation analysis, 11:10801 (R;AT;In German)
Monod, P., *See* Bonjour, E., 11:11505
Montano, P.A., *See* Cooper, B.R., 11:11131
Monteen, L.D., *See* Detwiler, J.S., 11:11223
Month, M., *See* Antillon, A., 11:11789
Moody, C.E. Jr., Model documentation for the Mini-Macroeconomic Model: MINMAC, 11:11392 (R;US)
Moody, M.C., Free energy difference calculations comparing fcc and hcp structures using molecular dynamics computer simulations, 11:12398 (J;US)
Moody, R., *See* Uziel, M., 11:11678
Moog, W., Cogeneration units and heat pumps for public swimming pools - a report on practical experience, 11:11439 (RA;DE;In German)
Mook, H.A., Momentum distribution of ^{3}He, 11:11593 (J;US)
Mookerjee, A., Structure of the scattering diagrams for conductivity in random binary alloys and the self-consistent CCPA, 11:11520 (R;IT)
Moore, S.P., Densitometric nondestructive microassay for DNA quantitation, 11:11963 (J;US)

Moore, T.I., Utility machinery vibration monitoring guide (Interim), 11:11226 (R;US)
More, J.J., *See* Calamai, P.H., 11:12518
Moreno, L., *See* Abelin, H., 11:11903
Moretto, L.G., Statistics at work in heavy-ion reactions, 11:12378 (BA;NL)
See Morrissey, D.J., 11:12346
Morford, G., *See* Vane, C.R., 11:12114
Morgan, T., *See* Blackman, J.A., 11:11533
Morgan, W., *See* Oliver, F.W., 11:11411
Morgenstern, M.H., Guidelines for preparing emergency procedures for nuclear power plants, 11:11327 (R;US)
Mori, S., *See* Chong, C.Y., 11:11210
Morozov, V.A., *See* Bonch-Osmolovskaya, N.A., 11:12336
Morris, J.W. Jr., *See* Fultz, B., 11:11522
Morris, R.N., ATF neutral beam injection: optimization of beam alignment and aperturing, 11:12497 (R;US)
Morrison, P.J., Spontaneous symmetry breaking and neutral stability in the noncanonical Hamiltonian formalism, 11:12434 (R;US)
See Berk, H.L., 11:12436
Morrissey, D.J., Sequential fission angular distributions from mass-asymmetric heavy-ion reactions, 11:12346 (J;NL)
Morse, J.W., Interaction of uranyl ions in carbonate media, 11:11727 (J;NL)
Mortazavi, H.R., Parametric study of a simplified model of coal face spalling, 11:10771 (RA;US)
Moss, J.M., Studies of nuclear structure via polarization transfer experiments, 11:12282 (R;US)
Mostek, S.D., *See* Crane, J.K., 11:12092
Motley, E.P., Hydraulics data and materials performance from phase I testing of coal water mixtures, 11:10795 (RA;US)
Moulin, J.P., *See* Guillaume, B., 11:10984
Mount, D.I., *See* Duke, T.W., 11:11916
Moussallam, B., Antinucleon nucleon annihilations into two mesons, 11:12156 (R;FR)
See Lacombe, M., 11:12191
Mozhaev, A.N., *See* Kozulin, Eh.M., 11:12338
Mrazek, F.C., *See* Battles, J.E., 11:11370
Mrochek, J.E., Thermal conductivities of Wilsonville solvent and Wilsonville solvent/Illinois No. 6 coal slurry, 11:10791 (R;US)
Mudlin, J.M., *See* Close, J.A., 11:11233
Muehry, H., *See* Macchiavelli, A.O., 11:12321
Muelder, S.A., *See* Maimoni, A., 11:11373
Muelsch, D., *See* Doerfel, B., 11:12247
Mulas, Eh., Correlations of emission frequency of π^0 mesons and proton produced in collisions of protons and π^0 mesons with xenon nuclei within the 2-9 GeV energy range and a problem of slow π^0 meson absorption in a target nucleus, 11:12161 (R;SU;In Russian)
Mulcahey, T.P., *See* Hornstra, F., 11:11363
Muller, A.B., *See* Hunter, T.O., 11:11061
Mullings, D.M., *See* Musikant, S., 11:11490
Munoz, R.C., Effect of high pressure on the electron mobility in liquid n-hexane, 2,2-dimethylbutane, and tetramethylsilane, 11:11686 (J;US)
Munro, J.K., *See* Baylor, L.R., 11:12477
Murakami, T., *See* Vandenbosch, R., 11:12351
Murata, T., Proceedings of the 1982 seminar on nuclear data, 11:12279 (R;JP;JA)
Murch, G.E., Monte Carlo calculation of correlation and vacancy wind effects in diffusion, 11:11550 (J;CH)
Murphy, B.L., *See* Swinth, K.L., 11:12000
Murphy, C.E. Jr., Gas exchange between the forest and the atmosphere, 11:11866 (R;US)
Murphy, G.A., *See* Greenstreet, W.L., 11:11273
Murphy, K., Development of a residential gas fired absorption heat pump. Physical and thermodynamic properties of R123A/ETFE system development and testing economic analysis. Final report, 11:11447 (R;US)
Murphy, K.D., Analysis of a customer-side-of-the-meter storage battery facility, 11:11218 (R;US)
See Magnani, N.J., 11:11372
Murphy, M.J., *See* Vandenbosch, R., 11:12351
Murphy, O.J., *See* Later, D.W., 11:11122
Murphy, P.W., *See* Rufer, M.L., 11:12505
Murray, J.P., *See* Kappauf, T., 11:11121
Murtagh, M.J., Same-sign dilepton production by neutrinos, 11:12141 (R;US)
Murty, B.A.R.C., Steady-state and laser flash photolysis studies of bridgehead-substituted dibenzobarrelenes, 11:11706 (J;US)
Musikant, S., Ceramic Automotive Stirling Engine study, 11:11490 (R;US)
Musikas, C., Actinide-lanthanide group separation using sulfur and nitrogen donor extractants, 11:11606 (R;FR)
Mutschleener, A.D., *See* Arthur, E.D., 11:12280
Myers, D.R., Disposal materials study, 11:11034 (R;US)
Myers, L.B., *See* Morgenstern, M.H., 11:11327

N

Nagamori, S., *See* Nagata, K.I., 11:10847
Nagata, K.I., Energy efficiency comparison of coal slurry transportation systems, 11:10847 (RA;US)
Nagy, M.F., *See* Feher, S., 11:11279
Nagy, Z., Electrode kinetic measurements of very fast reactions: metal deposition-dissolution in molten halides, 11:11366 (R;US)
Naldu, H.G., Coal reserves in Canada: 1983, 11:10814 (R;CA)
Naldu, J., *See* Kaplan, E., 11:12028
Naka, A., Slurry characteristics of CWS with Highcoal F-3225 in pilot scale production test, 11:10839 (RA;US)
Nakabayashi, Y., Slurry characteristics of various overseas coal bases on the pilot scale test, 11:10837 (RA;US)
Nalebuff, B., *See* Anand, S., 11:11377
Nankee, R.J., Chlorinated solvents for coal beneficiating, 11:10829 (RA;US)
Napier, W., *See* Stocker, H., 11:11077
Napper, P.R., *See* Gupta, V.P., 11:12329
Narayan, J., *See* Holland, O.W., 11:11594, 11:11596
See Pennycook, S.J., 11:11600
Narodetskij, I.M., *See* Grach, I.L., 11:12197
See Kalashnikova, Yu.S., 11:12198, 11:12199
Naseem, S., Indium tin oxide/gallium arsenide solar cells, 11:11171 (J;US)
Natesan, K., Effect of sulfur sorbent and gas cycling on corrosion of FBC materials at 866 K, 11:10896 (R;US)
NcNeil, M., *See* Albersheim, P., 11:11951
Negadi, T., *See* Kibler, M., 11:12089
Neitzel, D.A., *See* Bean, R.M., 11:11255
Nellis, W.J., *See* Holmes, N.C., 11:12136
Nelson, B.E., Mechanical testing and development of the helical field coil joint for the Advanced Toroidal Facility, 11:12481 (R;US)
Nelson, C.L., *See* Olsen, K.B., 11:10969
Nelson, C.R., *See* Uhler, R.G., 11:11400
Nelson, L.S., Effects of reactor core-simulant aerosols on hydrogen/air combustion, 11:11349 (R;US)
See Corradini, M.L., 11:11348
Nelson, R.O., FASTBUS data acquisition system for neutron time-of-flight measurements, 11:12387 (J;US)
Nemes, M.C., Dynamics of the nuclear one-body density: small amplitude regime, 11:12406 (R;BR)
Neretnieks, I., Source term modelling in the Swedish KBS - 3 study, 11:11063 (RA;US)
See Abelin, H., 11:11903
Nero, A.V., *See* Sextro, R.G., 11:11873
Nesnow, S., Metabolic activation pathways of cyclopenta-fused PAH (polycyclic aromatic hydrocarbons) and their relationship to genetic and carcinogenic activity, 11:11870 (R;US)
Nesterenko, V.O., *See* Bonch-Osmolovskaya, N.A., 11:12336
Neta, P., *See* Huie, R.E., 11:11683
Nevins, D.J., Depolymerization of matrix polysaccharides by endogenous wall enzymes, 11:11929 (RA;US)
Nevskaya, N.A., *See* Vagner, V., 11:11804
Newman, D.A., *See* Burkhalter, P.G., 11:11760
Newman-Holmes, C., *See* Yamada, R., 11:11821
Newton, P., *See* Lee, D.J., 11:11744
Neyhart, G.A., Excited state photoelectrochemical production of H_2O_2 and Br_2, 11:11175 (J;GB)
Neymotin, L.Y., *See* Slovik, G.C., 11:11298
Ng, B.W., *See* Stadlbauer, J.M., 11:12090
Ng, C.Y., *See* Liao, C.L., 11:12095, 11:12099
Ng, J.N., *See* Godfrey, S., 11:12255
Ngo, C., *See* Leray, S., 11:12348
Nguen Din' Vin', Fragmentation of subshells in rare earth nuclei, 11:12337 (R;SU;In Russian)
Nguyen, P.H., *See* Dupont, M., 11:11181
Nicaise, W.F., *See* Doerr, R.W., 11:11087
Nicholson, R., *See* Landry, G., 11:10845
Nicolas, N.G., *See* Coimbra, M.M., 11:12313
Nicolescu, B., From baryonium to hexons, 11:12194 (R;FR)
Nicoll, C., *See* Tomimura, A., 11:12472
Nicolis, N.G., *See* Toledo, A.S. de, 11:12314

Nikityuk, N.M., *See* Kalinnikov, V.A., 11:11835
Nikkinen, L., *See* Ravn, H.L., 11:12065
Nimick, F.B., Uniaxial and triaxial compression test series on Topopah Spring Tuff from USW G-4, Yucca Mountain, Nevada, 11:12033 (R;US)
Nishida, Y., *See* Naka, A., 11:10839
Nishikawa, M., *See* Munoz, R.C., 11:11686
Nixiol, K., *See* Swan, S.A., 11:10923
Nogar, N.S., Effect of very weak laser sidebands on optical spectra involving easily saturable intermediate states, 11:11634 (J;US)
Noguchi, M., *See* Sato, K., 11:12380
Nolan, T.A., *See* Cooley, J.N., 11:10982
Noonan, J.R., Truncation-induced relaxations of a high-index surface: Al(311), 11:12123 (J;NL)
Norby, R.J., *See* Shriner, D.S., 11:12009
Norman, M.L., 2-D Eulerian hydrodynamics with fluid interfaces, self-gravity and rotation, 11:12042 (R;US)
Norris, J.R., *See* Gast, P., 11:11705
Northcote, D.H., Control of cell wall assembly during differentiation, 11:11956 (RA;US)
Nothnagel, E.A., Membrane-bound β-lectins: agglutination of protoplasts by multivalent phenyl-β-glucosides, 11:11943 (RA;US)
Novaes, S.F., Anomalous Z^0 decay and a stronger coupled Higgs boson, 11:12185 (R;BR)
Novak, S.S., *See* Strojan, C.L., 11:11921
Novello, M., *See* Heintzmann, H., 11:12037
Novgorodov, A.F., Simple method of ^{111}In high temperature isolation from silver, 11:11720 (R;SU;In Russian)
Novkovic, D., Application of Si detectors, photo-diodes and G-M counters in exposure rate measurements, 11:11823 (RA;AT)
Nozik, A.J., *See* Brown, J.D., 11:11704
Nunz, G.J., Present status of hot dry rock technology, 11:11201 (R;US)

O

O'Brien, D.J., *See* Aston, T.R.C., 11:10800
O'Brien, J.N., Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)
O'Brien, T.J., Modeling of spray dryer desulfurization, 11:11220 (RA;US)
O'Connor, H.W., *See* Faulkner, A.R., 11:10849
O'Donnell, F.R., *See* Boegly, W.J. Jr., 11:11027
O'Donnell, H.W., Proven directional drilling techniques tested in Texas lignite, 11:10748 (RA;US)
O'Farrell, T.P., *See* McCue, P.M., 11:10937
O'Gallagher, J., Applications of maximally concentrating optics for solar energy collection, 11:11198 (J;US)
O'Grady, W.E., *See* Skotheim, T.A., 11:11701
O'Leary, L.S., *See* Aston, T.R.C., 11:10800, 11:10819
O'Neill, N.J., *See* Mirin, A.A., 11:12463
O'Neill, R.A., *See* Scott, T.K., 11:11931
O'Neill, R.V., *See* Urban, D.L., 11:11893
Oak, H.D., Decommissioning a boiling water reactor nuclear power plant, 11:11339 (R;US)
Obada, A.S.F., nlm→n'l'm' transition polarizability, magnetizability and susceptibilities for H atom, 11:12082 (R;IT)
Oberman, C., *See* Krommes, J.A., 11:12451
Ochrana, L., Utilization of conventional and nuclear power plant reliability information systems, 11:11216 (RA;CS;In Czech)
Oelrich, I.C., Small-turbine technology review. Final report, February-December 1984, 11:11457 (R;US)
Oen, O.S., *See* Holland, O.W., 11:11594, 11:11596
Ogram, G.L., *See* Dunstall, T.G., 11:11899
Ogura, Y., *See* Naka, A., 11:10839
Ohara, J.L., *See* Gilbert, E.S., 11:12005
Ohse, R.W., Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Ohta, N., Electron spin resonance study of chlorophyll a cation radical in photoirradiated frozen vesicle solutions with or without electron scavengers, 11:11703 (J;US)
Oka, T., *See* Liu, D., 11:12097
Okamitsu, J., *See* Baltay, C., 11:12166
Okos, M.R., *See* Dale, M.C., 11:11139
Okuda, S., *See* Suenaga, M., 11:11531
Ol'khovskij, V.S., Unification of the Krylov-Fock theorem and solution of Davydov paradox of the decaying systems, 11:12371 (R;UA;In Russian)
Olander, D.R., *See* Balooch, M., 11:11662
Oldenborg, R.C., *See* Baughcum, S.L., 11:11710
Olen, K.R., *See* Winters, P.J., 11:10867
Olivares, J.A., Suppression of analyte signal by various concomitant salts in inductively coupled plasma mass spectrometry, 11:11625 (J;US)
Oliveira, M.J. de, *See* Stilck, J.F., 11:12397
Oliver, F.W., Mossbauer studies on LaNi(4.7)Sn(0.3) and its hydride, 11:11411 (R;US)
Oliver, R.L., *See* Dana, G.F., 11:10749
Oliver, W.C., Hardness of ion implanted ceramics, 11:11556 (R;US)
Ollila, K., *See* Peltonen, E., 11:11037
Olsen, K.B., Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)
Olson, C.E., *See* Miyoshi, D.S., 11:11093
Olson, J., Objective indicators of organizational performance at nuclear power plants, 11:11335 (R;US)
Olson, T.J., Froth flotation for fine-coal cleaning. Final report, 11:10860 (R;US)
Ondrejka, S., *See* Kmosena, J., 11:11320
Ong, E.R., *See* Petri, R.J., 11:11360
Oosten, A.B. van, Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem, 11:11518 (R;IT)
Opekar, F., Determination of gaseous hydrogen sulfide by cathodic stripping voltammetry after preconcentration on a silver metalized porous membrane electrode, 11:11602 (R;US)
Organiscak, J.A., Factors affecting respirable dust generation from longwall roof supports. Information circular/1985, 11:10924 (R;US)
Oriani, R.A., Corrosion Research Center of the University of Minnesota. Progress report, January 1-December 31, 1985, 11:11513 (R;US)
Orlic, M., *See* Novkovic, D., 11:11823
Orphanos, L., *See* Minehart, R.C., 11:12293
Orszag, M., Squeezing and antibunching in a one electron FEL model, 11:12402 (R;IT)
Osborn, R.N., *See* Olson, J., 11:11335
Osenbach, J.W., *See* Stubican, V.S., 11:11566
Oseroff, S.B., *See* Gandra, F., 11:11535
Oswald, R.S., *See* Carlson, D.E., 11:11165
Ott, E., *See* Meiss, J.D., 11:12416
Ott, H.R., *See* Golding, B., 11:11536
Ottewell, D.F., *See* Ziegler, W., 11:12305
Ouzounian, G., Study in applied geochemistry. Geothermal water, 11:11203 (R;FR;In French)
Overbeek, R.A., *See* Glickfeld, B.W., 11:12517
Oversby, V.M., Laboratory experiments designed to provide limits on the radionuclide source term for the NNWSI project, 11:11069 (RA;US)
Owca, W.A., Pretest analysis document for Test S-NH-1, 11:11310 (R;US)
Owens, T.L., *See* Baity, F.W., 11:12428

P

Pacheco, A.J., *See* Morrissey, D.J., 11:12346
Pack, R.W., Human engineering design guidelines for maintainability. Final report, 11:11314 (R;US)
Packan, N.H., *See* Lee, E.H., 11:11509
Paffenhoefer, G.A., Biological processes in the water column of the South Atlantic Bight: zooplankton responses. Progress report, June 1985-June 1986, 11:11906 (R;US)
Paffenhofer, G.A., *See* Blanton, J.O., 11:11913
Paisner, J.A., *See* Crane, J.K., 11:12092
Paixao, F.J. da, Many-Body theory of electron impact excitation from metastable targets, 11:12126 (BA;NL)
Pal, S.P., *See* Ranogajec-Komor, M., 11:11825
Paligoric, D., *See* Dobrilovic, L., 11:11828
See Novkovic, D., 11:11823
Palinkas, J., Alignment of the 2P-states of He-like Ne recoil ions produced by 1.35 MeV/a.m.u. Ar ion impact, 11:12071 (RA;US)
Delayed emission of 2p-1s and 3p-1s X-rays from 40 MeV neon ions ionized in a thin carbon foil, 11:12073 (RA;US)
Nonstatistical population of the 1s2p 2^1P_1 and 2^3P_1 states in recoil ions produced by heavy ion impact, 11:12072 (RA;US)

Projectile velocity dependence of the alignment of He-like 2P-states of foil excited S projectiles, 11:12070 (RA;US)
See Bandong, B., 11:12075, 11:12076
See Demarest, J.A., 11:12074
See Pedrazzini, G.J., 11:11815
Palmadesso, P.J., *See* Ganguli, S.G., 11:12054
Palmer, H.E., *See* Swinth, K.L., 11:12000
Palmer, M.E., A portable nondestructive assay measurement control system, 11:11086 (J;US)
Palmer, R.S., *See* Stauffer, T.R., 11:11265
Palmieri, H.E.L., High precision spectrophotometric analysis of thorium, 11:11618 (R;BR;In Portuguese)
Palumbo, R., *See* Kappauf, T., 11:11121
Palx, K., Influence of H_2O at high PT-conditions upon the volumetric and mobility behavior of bituminous coal for in-situ-gasification after linking-process, 11:10761 (RA;US)
Pancholi, S.C., *See* Fewell, M.P., 11:12120
Panessa-Warren, B.J., Cation shifts in human retina-choroid, 11:11965 (R;US)
Pannert, W., Analysis of angular-momentum-projected Hartree-Fock-Bogoliubov wave functions in terms of interacting bosons, 11:12376 (J;NL)
Pantell, R.H., *See* Berman, B.L., 11:11597
Pardo, R., *See* Kutschera, W., 11:11726
Parfenov, Yu.V., Sum rules and high-energy asymptotics of pion-pion amplitude for large angles, 11:12189 (R;SU;In Russian)
Park, H., *See* Berman, B.L., 11:11597
Park, J.Y., *See* Shack, W.J., 11:11231
Park, K.Y., Analysis of early cavity growth in underground coal gasification, 11:10767 (RA;US)
Park, W., *See* White, R.B., 11:12449
Parker, H.M., Ground disposal of radioactive wastes at the Hanford site, 11:11901 (R;US)
Parker, J., m = 1, n = 1 oscillations following the injection of a fuel pellet on the Alcator C tokamak, 11:12492 (R;US)
Parkhurst, M.A., *See* Hadlock, D.E., 11:11836
Parks, R.I., *See* Shapira, D., 11:12308
Parsons, D.K., *See* Lake, J.A., 11:11283
Parthasaradhi, K., *See* Bandong, B., 11:12075
Passau, V., *See* Gorez, R., 11:10766
Pate, B.D., *See* Adam, M.J., 11:11723, 11:11724
Patel, R.C., *See* Hauserman, W.B., 11:10827
Patigny, J., Status of the joint Belgo-German experiment of underground coal gasification, 11:10745 (RA;US)
Patterson, C.W., Circular intensity differential scattering of light by hierarchical molecular structures, 11:11948 (J;US)
Patterson, J.F., *See* Ewing, R.H., 11:11232
Patterson, J.T., *See* Dale, M.C., 11:11139
Patterson, L.K., *See* Agrawal, M.L., 11:11687
Paul, M., *See* Kutschera, W., 11:11726
Paul, R.A., Next phase of WIDCO's Tono project, 11:10777 (RA;US)
See Kilpatrick, M.P., 11:10750
Paulson, L.E., Design, cost and economic benefits of ion exchange process to remove sodium from lignite, 11:10853 (RA;US)
Pavlov, V., Improving spray system reliability, 11:11321 (RA;CS;In Russian)
Pavlovskis, O.R., *See* Gruber, D.F., 11:11989
Pavone, D., Self-ignition and reverse combustion setting of operating conditions for the Haute Deule site test, 11:10753 (RA;US)
See Gadelle, C., 11:10768
Pawlak, T., *See* Strugalski, Z., 11:12383
Payer, J.H., *See* Razgaitis, R., 11:11413
Payne, B.A., *See* Williams, R.G., 11:11389
Payne, M.G., *See* Hurst, G.S., 11:12172
Payne, R., NO/sub x/ formation and control in pulverized-coal flames, 11:11221 (RA;US)
Peck, C.W., *See* Bloom, E.D., 11:11841
Pederson, L.R., *See* Strachan, D.M., 11:11060
Pedrazzini, G., *See* Palinkas, J., 11:12072
Pedrazzini, G.J., Design and calibration of an X-ray polarimeter, 11:11815 (RA;US)
IBM PC-based spectrometer control system, 11:11817 (RA;US)
See Bandong, B., 11:12075, 11:12076
See Palinkas, J., 11:12071
Peebles, W.A., *See* Brower, D.L., 11:12465
Peeler, H., *See* Haisler, R., 11:11798
Peggie, J.R., *See* Solomon, S.B., 11:12388
Pekic, B., Production of alcohol from Jerusalem artichoke for gasoline additive, 11:11143 (R;US)
Pellegrin, P.O., Study and realization of a parallel plate avalanche counter used for time of flight and localization measurements, 11:11834 (R;FR;In French)
Pellet, S., Effects of irradiation on frozen corticocancellous bone allograft incorporation and immunogenicity. Final report, 11:11988 (R;US)
Pelroy, R.A., *See* Wright, C.W., 11:10927
Pelton, A.R., *See* Brimhall, J.L., 11:11539
See Wadsworth, J., 11:11542
Peltonen, E., Release mechanisms and their role in the spent fuel repository perfomance, 11:11037 (RA;US)
Penaforte, J.C., Laser theory in the absence of adiabatic hypothesis: linear approximation, 11:12411 (R;BR)
Quantum theory of a one-dimensional laser with output coupling. 2. Nonlinear theory, 11:12410 (R;BR)
Peng, Y.K.M., Features of spherical torus plasmas, 11:12442 (R;US)
See Selcow, E.C., 11:12429
Penionzhkevich, Yu.Eh., *See* Kozulin, Eh.M., 11:12338
Penland, R.K., Industry's role in exporting UCG technology, 11:11397 (RA;US)
Penner, H.A., Experimental study of coal ash catalyzed reactions between carbon monoxide and hydrogen, 11:10759 (RA;US)
Pennycook, S.J., Enhanced diffusion from interstitial trapping during solid-phase-epitaxial growth of silicon alloys, 11:11600 (J;NL)
Pepmiller, P.L., *See* Andrews, M.C., 11:12110, 11:12111
See Miller, P.D., 11:12118
See Rosseel, T.M., 11:12115
Percival, C.M., ISHTE: component test cruise report. In Situ Heat Transfer Experiment (Atlas Cruise, Leg 1), September 1984, 11:11039 (R;US)
Perez, J.F., Bound-states of N particles: a variational approach, 11:12407 (R;BR)
Perkins, S.T., A reevaluation of the ^{9}Be(n,2n) reaction and its effect on neutron multiplication in fusion blanket applications, 11:12309 (J;US)
Perlack, R.D., *See* Wright, L.L., 11:11163
Perone, S.P., Coping with the information explosion provided by modern chemical instrumentation, 11:12527 (J;US)
Perrin, C., *See* Kox, S., 11:12302
Perrin, G.R., Evaluation of five methods of dimensioning passive solar systems, 11:11188 (RA;CH;In French)
Perry, A.M., *See* Alexander, C., 11:12051
Perry, R.T., *See* Wilson, W.B., 11:11254
Pershing, D.W., *See* Payne, R., 11:11221
Persson, P.O., Cold: An important factor in the food industry, 11:11428 (RA;DE;In German)
Pervushin, V.N., Topological color confinement, 11:12250 (R;SU;In Russian)
See Bel'kov, A.A., 11:12187, 11:12205
Pessoa, E.F., *See* Carlin Filho, N., 11:12299
See Schelin, H.R., 11:12298
Peterman, W., *See* Bhattacharyya, S., 11:11516
Peters, C., *See* Taylor, C.E., 11:11805
Peterson, J.E., *See* Ryther, J.H., 11:11170
Peterson, T.W., *See* Linak, W.P., 11:10906, 11:10907, 11:11734
Petko, C., Environmental Radiation Data report 29: January-March 1982, 11:11883 (R;US)
See Mardis, M., 11:11884
Petko, C.M., Environmental Radiation Data report 30, April-June 1982. Quarterly report, 11:11885 (R;US)
Petoe, A., New Monte Carlo electron transport code for beta dosimetry, 11:11830 (RA;AT)
Petrasso, R., *See* Parker, J., 11:12492
Petri, R.J., High temperature composite thermal storage systems for industrial applications, 11:11360 (R;US)
Petro, N., *See* Misak, N.Z., 11:11612
Petrukhin, V.I., *See* Bystritskij, V.M., 11:12087
Pfeffer, J.T., *See* Suidan, M.T., 11:10803
Pfeiffenberger, U., Low-cost, energy-saving air conditioning systems for department stores and supermarkets, 11:11431 (RA;DE;In German)
Philippe, J.L., *See* Gadelle, C., 11:10768
Phillips, B., *See* Murphy, K., 11:11447
Phillips, J.E., *See* Birkmire, R.W., 11:11164
Phillips, R.D., Biological effects of electric fields, 11:12024 (R;US)
Picard, C., *See* Quensanga, A., 11:11125
Picard, R.R., *See* Pillay, K.K.S., 11:11088
Picataggio, S.K., *See* Stoke, H.W., 11:11145
Picciotto, C., Rate suppression with three generations of Majorana neutrinos, 11:12208 (R;CA)
See Kopac, J., 11:12207
Pickering, M.A., *See* Greene, E.F., 11:11667
Pickrell, P.W., *See* Bostick, W.D., 11:11070
Picton, J.M., *See* Steer, M.W., 11:11962

Piepenbring, R., Decomposition of the SO(6) symmetric representations into SU(2)xSU(2)xU(1), 11:12217 (R;FR)
Pierce, R.D., *See* Krumpelt, M., 11:11408
Pietrafesa, L.J., *See* Blanton, J.O., 11:11913
Pigford, T.H., Reliable predictions of waste performance in a geologic repository, 11:11059 (R;US)
Piksaikin, V., Planning for the REAL-84 project on adjustment procedures. Report of an IAEA consultants' meeting held in Hamburg, Federal Republic of Germany, 26 September 1984, 11:11924 (R;XA)
Pile, P.H., Beams for kaon research, 11:11793 (R;US)
Pillay, K.K.S., Estimation methods for special nuclear materials holdup, 11:11088 (J;US)
Pin, F.G., *See* Boegly, W.J. Jr., 11:11027
Pinder, G.F., *See* Abriola, L.M., 11:11897
Piraino, M., *See* Metz, P.D., 11:11119, 11:11120
Pires, J., Reliability evaluation of containments including soil-structure interaction, 11:11332 (R;US)
Pirner, H., *See* Wilets, L., 11:12225
Pirner, H.J., *See* Schuh, A., 11:12361
Piskunova, O.I., *See* Veselov, A.I., 11:12202
Pitner, A.L., TS-1 and TS-2 transient overpower tests on FFTF fuel, 11:11315 (R;US)
Planchon, H.P., EBR-II Shutdown Heat Removal Testing Program results and plans, 11:11299 (R;US)
Platt-Aloia, K.A., *See* Herman, E.M., 11:11959
Plechaty, E.F., *See* Perkins, S.T., 11:12309
Pleitez, V., *See* Novaes, S.F., 11:12185
Plessas, W., *See* Loiseau, B., 11:12193
Plumley, A.L., Predicting and assessing tube metal wastage in boilers fired with low-rank coal, 11:11213 (RA;US)
Pluta, J., *See* Strugalski, Z., 11:12383
Plyushchaj, M.S., Baryon string model. 1. Canonical formalism and general solution of classical equations of motion for the three-string, 11:12190 (R;SU;In Russian)
Pochard, R., Research program on mechanical and thermodynamic interactions between principal vapor flow and emergency water injection in a PWR reactor. Volume I. (Part I. EPIS I Experiment) Test Operations, 1975-1976, 11:11357 (TG;US)
Poenaru, V., *See* Nicolescu, B., 11:12194
Poeppel, R.B., *See* Greenberg, S., 11:11552
Pohl, J.H., Achieving high combustion efficiency burning coal-water fuels, 11:10862 (RA;US)
Correlation of the spray characteristics of coal-water-fuels, 11:10863 (RA;US)
See Richter, W., 11:10868
Poitou, J., π^+ and π^- production in the α-nucleus and nucleus-nucleus collisions between 200 and 800 MeV/nucleon, 11:12342 (R;FR;In French)
Polach, J., Reliability of power plant supply pumps and special valves, 11:11272 (RA;CS;In Czech)
Poletti, A.R., Magnetic moments, E3 transitions and the structure of high spin core excited states in ^{211}Rn, 11:12341 (R;AU)
Yrast spectroscopy of ^{209}Rn, 11:12340 (R;AU)
Poletti, S.J., *See* Poletti, A.R., 11:12341
Polgar, I., *See* Zarand, P., 11:11826
Pomeroy, L.R., *See* Blanton, J.O., 11:11913
Pomraning, G.C., *See* Larsen, E.W., 11:12423
Ponomarev, V.Yu., Possibility of excitation twist mode selection in the (e, e') reaction, 11:12330 (R;SU;In Russian)
Pontau, A.E., *See* Bastasz, R., 11:12471
Poore, R.V., *See* Nelson, R.O., 11:12387
Popov, O.E., *See* Kogarko, S.M., 11:11738
Popov, Yu.P., Correlation between the partial cross sections for the ^{174}Yb(n,2γ)^{175}Yb and ^{176}Yb(d,t)^{175}Yb reactions, 11:12335 (R;SU;In Russian)
Porter, G.K., *See* Gessiness, B., 11:11099
Porter, R., Verti Jack Pumping Unit evaluation, 11:10931 (R;US)
Pottag, F.W., *See* Hama, Y., 11:12130, 11:12131
Potter, M.E., *See* Allen, R.C., 11:12168
Pottier, M., *See* Gadelle, C., 11:10747
Poukey, J.W., *See* Freeman, J.R., 11:12094
Poutissou, J.M., Rare decays of neutral π and eta, 11:12206 (R;CA)
Powell, M.F., Mechanism of tritium-atom promoted isotope exchange in the benzene ring. 2. Substituent effects and a crossover in labelling mechanism, 11:11693 (J;US)
Power, J.D., *See* Dawkins, H.C., 11:10810
Powers, T.B., Probabilistic risk assessments modeled on a micro-computer, 11:11342 (R;US)
Pratapan, S., *See* Murty, B.A.R.C., 11:11706
Prater, R., Review of electron cyclotron heating experiments in toroidal devices, 11:12439 (R;US)
See Hsu, J.Y., 11:12458
Pratt, J.C., *See* Cooley, J.N., 11:10982
Pratt, W.T., *See* Ludewig, H., 11:11297
See Shiu, K.K., 11:11293
See Yang, J.W., 11:11296
Pratuch, S.M., *See* Shukla, S.N., 11:11749
Prechter, R.E., *See* Grisham, L.R., 11:12511
Predazzi, E., *See* Bediaga, I., 11:12180, 11:12181
Prentki, R.T., *See* Allen, G.H., 11:10940
Preston, R., *See* Schoofs, G., 11:11670
Preult, L.C., *See* Eustis, R.H., 11:11483
Pribac, F., *See* Burnett, S.M., 11:12326
Price, L.E., Soudan nucleon decay experiments, 11:11844 (J;US)
Price, M.S.T., Investigation of non-destructive techniques for the examination and quality assurance of cemented radioactive waste. Final report, 11:10994 (R;GB)
Price, R.H., Uniaxial and triaxial compression test series on two types of foundry stone, 11:11038 (R;US)
See Nimick, F.B., 11:12033
Prichard, B.A. Jr., *See* Grisham, L.R., 11:12511
Proco, G., DOE oversight of facility confirmatory measurement activity, 11:11098 (J;US)
Proctor, A.E., Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel, 11:11108 (J;US)
Proffitt, D., *See* Lee, D.J., 11:11744
Pron'ko, G.P., *See* Plyushchaj, M.S., 11:12190
Proscia, W.M., *See* Seery, D.J., 11:10784
Protopopescu, S.D., *See* Chung, S.U., 11:12140
Pryke, D.C., Calculated solubilities of actinides and some fission and activation products under disposal conditions, 11:10996 (R;GB)
Pryor, W.A., *See* Barlow, C.R., 11:11746
Puls, M.P., Hydrogen-induced cracking: 2. Effect of stress on nucleation, growth and coarsening of zirconium hydride precipitates, 11:11504 (R;CA)
Pursey, D.L., *See* Luban, M., 11:12415
Purucker, S.L., *See* Detwiler, J.S., 11:11223
Pyle, R.V., *See* Stearns, J.W., 11:12119
Pytlinski, G., Solar energy technologies in Puerto Rico, 11:11182 (RA;PR)
Pytlinski, J.T., Potential applications of solar energy in the Republic of Panama, 11:11179 (RA;PR)

Q

Qi, Z.M., *See* Wang, Y.S., 11:10882
Qin, X.Z., ESR evidence for localized forms of C-C ring-opened oxirane radical cations, 11:11715 (J;US)
Quartucy, G.C., *See* Taback, H.J., 11:10968
Quast, U., Energy consumption of various different switching systems for compound equipment in supermarkets, 11:11425 (RA;DE;In German)
Quensanga, A., Pyrolysis of sugar cane bagasse, 11:11125 (RA;PR)
Quinn, G.J., *See* Henrie, J.O., 11:11079

R

Rabideau, P.W., Studies of metal ammonia interactions with aromatic substrates. Final report, December 18, 1979-February 28, 1985, 11:11671 (R;US)
Raby, S., *See* Bjoerkman, J.E., 11:12265
Radovanovic, R., *See* Tomasevic, M., 11:11976
Radyushkin, A.V., *See* Khalmuradov, R.S., 11:12246
See Mikhajlov, S.V., 11:12249
Raffoux, J.F., *See* Gadelle, C., 11:10747
Rahman, A., Molecular dynamics studies of structural transformation in solids, 11:11549 (J;CH)
See Moody, M.C., 11:12398
Rajeshwar, K., Electrodeposition of p-CdTe and CdS/CdTe heterojunction devices. Final subcontract report, September 1983-May 1985, 11:11589 (R;US)
Ralston, J.P., Covariant method for soliton matrix elements, 11:12259 (J;US)
Raman, S., *See* Rosseel, T.M., 11:12115
See Vane, C.R., 11:12114
Ramberg, E., *See* Steinberg, P., 11:12148
Ramdane, D., Capabilities of light element surface analysis by nuclear

microanalysis, 11:11617 (R;FR;In French)
Rameau, J.T.L.B., Lead as an environmental pollutant, 11:11895 (RA;XE)
Ramig, J., *See* Anderson, E., 11:12026
Ramirez, A., *See* Iriarte, M. Jr., 11:11206
Ramirez, R., *See* Orszag, M., 11:12402
Randa, M., *See* Drahy, J., 11:11245
Rankin, D.M., *See* Whaley, H., 11:10891
Rankin, W.L., *See* Morgenstern, M.H., 11:11327
Ranney, J.W., *See* Wright, L.L., 11:11163
Ranogajec, M., *See* Dvornik, I., 11:11827
Ranogajec-Komor, M., Characteristics of some TLDs for low dose measurement, 11:11825 (RA;AT)
Rao, H.P.R., *See* Ayoub, M.M., 11:12027
Rapp, P., *See* Kunori, S., 11:12153
Rasneur, B., *See* Roth, E., 11:12474
Ratzel, A.C., SMOKE: a data reduction package for analysis of combustion experiments, 11:11740 (R;US)
Ravn, H.L., Methods for on-line production of radioactive ion-beams in the $2 < Z < 21$ region, 11:12065 (R;CH)
Rawlins, D.C., *See* Germane, G.J., 11:10794
Ray, A., *See* Vandenbosch, R., 11:12351
Ray, D., Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet, 11:12096 (J;US)
Ray, J.R., *See* Moody, M.C., 11:12398
Rayburn, L.A., *See* Andrews, M.C., 11:12110, 11:12111
Raynaud, M., *See* Besson, J.C., 11:11813
Razgaitis, R., Condensing heat exchanger systems for residential/commercial furnaces and boilers. Phase IV, 11:11413 (R;US)
Razumov, A.V., *See* Plyushchaj, M.S., 11:12190
Razvi, J., *See* Smith, B.W., 11:11090
Read, P.J., *See* Whaley, H., 11:10891
Reading, J.F., *See* Becker, R.L., 11:12102
Recio, L., Detoxication mechanisms of benzo(a)pyrene as studied in the CHO/HGPRT assay, 11:12006 (R;US)
Reece, W.D., Extremity monitoring: considerations for use, dosimeter placement, and evaluation, 11:11998 (R;US)
Reed, A.W., *See* Ratzel, A.C., 11:11740
Reed, D.T., Effect of alpha and gamma radiation on the near-field chemistry and geochemistry of high-level waste packages, 11:11031 (R;US)
Reed, J.G., Modeling of reflux condensation and countercurrent annular flow in a two-phase closed thermosyphon, 11:11312 (R;US)
Reed, J.H., *See* Detwiler, J.S., 11:11223
Reed, R.R., *See* Carlton, C.H., 11:10836
Reed, R.W. Jr., Process and equipment capabilities, Materials Joining Laboratory, 1985, 11:11747 (R;US)
Rees, J.H., *See* Pryke, D.C., 11:10996
Reeves, D., *See* Chung, S.U., 11:12140
Rehm, B.W., *See* Groenewold, G.H., 11:10802
Rehm, K.E., *See* Kutschera, W., 11:11726
Rehr, J.J., *See* Wilets, L., 11:12225
Reich, M., *See* Hwang, H., 11:11225
See Pires, J., 11:11332
Reid, J.S.G., *See* DeMason, D.A., 11:11938
See Sexton, R., 11:11955
Reidinger, F., *See* Reilly, J.J., 11:11567
Reifenberger, R., Study of the interaction of light with sub-micron metallic surfaces. Progress report, 11:12080 (R;US)
Reilly, C.A., *See* Gray, R.H., 11:10793
Reilly, J.J., Irreversible effects in the FeTi-H system, 11:11567 (J;CH)
Reimoneng, A., *See* Abillon, J.M., 11:11184
Reimund, J., Main magnet power supply, 11:11797 (RA;US)
Reinhard, P.G., *See* Cusson, R.Y., 11:12306
Reinmuth, F., Modernisation of the energy engineering in large buildings, as in the example of Freiburg University, 11:11433 (RA;DE;In German)
Reiter, E.R., General circulation variability, medium to long-range forecasting, and energy industry related applications. Final report, 1 January 1983-31 December 1985, 11:11861 (R;US)
Statistical look at air-sea interaction in the North Pacific, 11:11908 (R;US)
Renne, R.A., *See* Gray, R.H., 11:10793
Rennie, A.G., *See* Allen, J.W., 11:10865
Renz, H., Rapid freezing equipment with two-level screw compressor system, 11:11429 (RA;DE;In German)
Rettig, C.L., *See* Baity, F.W., 11:12428
Rhee, M.J., Inductively insulated Marx generator, 11:11806 (J;US)
Rhodes, D.W., Investigation of the effect of waste disposal procedure modifications on disposal of D-2 waste to the ground, 11:11902 (R;US)
Rich, B.L., Protective force legal issues: the security perspective, 11:11095 (J;US)
Richards, J.R., Audit of joint owner costing and billing practices, Naval Petroleum Reserve No. 1, Elk Hills, California, 11:12515 (R;US)
Richards, P., *See* Srivastava, S. C., 11:11982
Richards, R.K., *See* Glowienka, J.C., 11:12444
See Walker, M.A., 11:12445
Richardson, I.G., *See* Tsurutani, B.T., 11:12058
Richardson, J.W. Jr., Fourier-filtering techniques for the analysis of high-resolution pulsed neutron powder diffraction data, 11:11557 (R;US)
Richardson, M.C., *See* Delettrez, J., 11:12485
See Jaanimagi, P.A., 11:12490
Richmond, P.A., Cellulose synthesis inhibition, cell expansion, and patterns of cell wall deposition in Nitella internodes, 11:11961 (RA;US)
See Taiz, L., 11:11983
Richter, W., Scale-up of coal water fuels experiments in pilot furnaces for evaluation of utility boiler performance, 11:10868 (RA;US)
Riddell, F.R., *See* Oelrich, I.C., 11:11457
Riedinger, L.L., *See* Fewell, M.P., 11:12120
Riemann, T., *See* Akhundov, A.A., 11:12203
Riepe, K.B., *See* Smith, I.D., 11:11856
Riez, S., *See* Berenyi, D., 11:12086
Riggs, J.B., *See* Kennedy, K.M., 11:10762
Rillema, D.P., *See* Geiger, D.K., 11:11682
Rimsaite, J., Petrography, petrochemistry and mineral associations of selected rocks and radioactive occurrences north of Mont-Laurier, Quebec. A progress report, 11:10973 (RA;CA)
Ring, P., *See* Pannert, W., 11:12376
Rini, M.J., *See* Cook, D.A., 11:10890
See LaFlesh, R.C., 11:10877
Ritter, A.M., *See* Cieslak, M.J., 11:11545
Rivard, J.B., Core material redistribution accompanying accident sequences leading to degraded cores, 11:11346 (R;US)
Rivera, T., Fundamental research on explosives program, 11:11850 (J;US)
Riyopoulos, S., Effect of toroidicity during lower hybrid mode conversion, 11:12433 (R;US)
Rizk, G.S., Fermentation ethanol can be a partial solution to the energy crisis, 11:11135 (RA;PR)
Rizy, D.T., *See* Detwiler, J.S., 11:11223
Roach, F., *See* Altseimer, J.H., 11:11410
Robbins, G.A., *See* Winschel, R.A., 11:10783
Robbins, J.A., Coupled lakes model for estimating the long-term response of the Great Lakes to time-dependent loadings of particle-associated contaminants. Technical Memo., 11:11919 (R;US)
Great Lakes regional fallout source functions. Technical memo., 11:11920 (R;US)
Roberson, P.L., *See* Reece, W.D., 11:11998
Roberts, E.R., High-pressure study of rhodamine B in solution and adsorbed on oriented single-crystal ZnO, 11:11690 (J;US)
Roberts, F.P., *See* Byers, K.R., 11:11085
Robertson, D.E., *See* Olsen, K.B., 11:10969
Robertson, R.E., Extraction of Green River and Chattanooga oil shales with strong bases and nucleophilic displacement reagents, 11:10967 (R;US)
Robinson, D.G., Intracellular localization of hydroxyproline-rich glycoprotein biosynthesis, 11:11930 (RA;US)
Robinson, H.H., *See* Itoh, S., 11:11174
Robinson, R.L., *See* Ray, D., 11:12096
Rockett, P.D., *See* Burkhalter, P.G., 11:11760
Rockhold, H.C., *See* Cook, T.L., 11:11239
Rodeman, R., Exact integration algorithm for use with modal analysis, 11:11743 (R;US)
Rodenburg, W.W., *See* Strohm, W.W., 11:11107
Rodriguez, R., *See* Albeverio, S., 11:12055
Roellig, L.O., *See* Lynn, K.G., 11:11114
Rogers, R.C., K500 RF system, 11:11800 (RA;US)
See Laune, B., 11:11785
Rogers, R.N., *See* Shackelford, S.A., 11:11694
Rogers, W.R., Effects of 60 Hz electric fields on operant and social stress behavior of nonhuman primates. Quarterly technical progress report No. 20, September 28-December 20, 1985, 11:12016 (R;US)
Rognlien, T.D., Monte Carlo particle simulation and finite-element

techniques for tandem mirror transport, 11:12456 (R;US)
Rohatgi, N.D., Pneumatic transport of coal in a variable inclined test loop. Quarterly report 2, 11:10858 (R;US)
Rohatgi, U.S., Comparative analysis of constitutive relations in TRAC-PF1 and RELAP5/MOD1, 11:11234 (R;US)
Roman, E., Effect of microscopic structure of metal electrode on capacitance of metal - molten salt interface, 11:11519 (R;IT)
Romani, G., *See* Mills, B., 11:10872
Rome, J.A., *See* Morris, R.N., 11:12497
Romero, C.A., Characterization of a non-uniform retort using tracer techniques, 11:10971 (J;US)
Ronaky, J., *See* Feher, S., 11:11279
Ronchi, C., Advanced-fuel performance model Euges-Aries. Description and listing of the computer program and introduction to its use, 11:11258 (R;DE)
Ronde, H., Heat exchange effects during underground gasification of thin coal layers, 11:10754 (RA;US)
Rosa, G., *See* Feher, S., 11:11279
Rosa, L.P., *See* Salama, C., 11:11127
Rosen, J., High energy experimental physics. Progress report and renewal proposal, 11:12145 (R;US)
Rosen, S.P., *See* Fowler, W.A., 11:12177
Rosenberg, L.J., Study of hadronization using energy flow from e^+e^- annihilation into quarks and gluons at $\sqrt{s}$ of 29 GeV, 11:12163 (R;US)
Rosenblum, M., Synthesis and properties of novel electroactive organometallic polymers. Annual progress report, March 7-December 1, 1985, 11:11673 (R;US)
Rosenbluth, M.N., *See* Eliezer, S., 11:12494
Rosenfeld, A., Energy conservation in large buildings, 11:11452 (J;US)
Rosenfeld, A.H., Residential energy efficiency: progress since 1973 and future potential, 11:11451 (J;US)
Rosenfield, A.R., Damage analysis of creep in bending, 11:11561 (J;US)
Multiaxial stress response of ceramics. Progress report, December 1, 1984-November 30, 1985, 11:11553 (R;US)
Rosner, J.L., *See* Dawson, S., 11:12216
Ross, D., Computation of the transonic flow about a swept wing in the presence of an engine nacelle, 11:12127 (R;US)
Ross, M., Matter under extreme conditions of temperature and pressure, 11:11661 (J;GB)
Rosseel, T.M., Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
See Andrews, M.C., 11:12110, 11:12111
Rostaing, M., *See* Sauneuf, A., 11:12426
Rote, D.M., Radioactive waste isolation in salt: peer review of Westinghouse Electric Corporation's report on reference conceptual designs for a repository waste package, 11:10997 (R;US)
Rotella, F.J., *See* Fahey, J.A., 11:11651
Roth, E., Irradiation of lithium aluminate and tritium extraction, 11:12474 (R;FR)
Rothfeld, L.B., *See* Pohl, J.H., 11:10862, 11:10863
See Sepulveda, J.L., 11:10844
Rothstein, D., *See* Huang, J.C., 11:11665
Rottloff, R., Determination of the left ventricular volumina by computerized tomography, as compared to laevo-angiocardiography, 11:11977 (R;DE;In German)
Roturier, J., *See* Andriamonje, S., 11:12064
Roux, N., *See* Roth, E., 11:12474
Rowan, W.L., *See* Isler, R.C., 11:12468
Rowland, F.S., *See* Iyer, R.S., 11:11685
Rowley, D.R., Fluidized bed combustion of coal-water slurry, 11:10879 (RA;US)
Rowley, J.K., *See* Davis, R. Jr., 11:11842
Roy, D.M., Thermal properties of fly ash substituted slag cement waste forms for disposal of Savannah River Plant salt waste, 11:11010 (R;US)
Ruan, X.Q., *See* Guo, C.T., 11:10830
Rubakov, V.A., *See* Kuzmin, V.A., 11:12183
Rubey, W.A., Aspects of high-resolution gas chromatography as applied to the analysis of hydrocarbon fuels and other complex organic mixtures. Volume 2. Survey of sample-insertion techniques. Final report, January-September 1980, 11:11603 (R;US)
Rubio, R.G., Theoretical and experimental study of the equation of state of tetrafluoromethane, 11:11677 (J;US)
Ruby, J.D., Conventional coal cleaning of high-ash low-rank coals, 11:10852 (RA;US)
Rudaz, S., *See* Stecker, F.W., 11:12047
Rudenko, A.I., *See* Bystritskij, V.M., 11:12087
Ruderman, H., *See* Levine, M.D., 11:11455
Rufer, M.L., Laser Program annual report 1984, 11:12505 (R;US)
Ruiz-Herrera, J., *See* Diaz, S., 11:11939
Runge, K., *See* Zappe, D., 11:11035
Rushton, A.M., *See* Allen, R.C., 11:12168
See Bernard, C., 11:12212
Russell, D.H., Investigations on multiphoton ionization and laser-ion beam photodissociation spectroscopy. Final report, 11:11702 (R;US)
Russell, J.A., *See* Easterling, J.C., 11:11144
Russell, J.E., *See* Rote, D.M., 11:10997
Russell, N.S., Comparison of retrospective testing with statistical tests in near real time materials accountancy, 11:11084 (R;GB)
Ruth, T., *See* Dombsky, M., 11:12344
Ruth, T.J., *See* Adam, M.J., 11:11723, 11:11724
Ruther, W.E., *See* Shack, W.J., 11:11231
Rutherford, P.H., *See* White, R.B., 11:12449
Ruzicka, V., Summary on uranium in Canada, 1984, 11:10972 (RA,CA)
See Bell, R.T., 11:10975
Ryan, E.A., *See* Taylor, A., 11:11544
Ryan, R.B., Use of coal-water fuels in a contemporary steam locomotive, 11:10884 (RA;US)
Ryan, R.R., *See* Kubas, G.J., 11:11657
Rybicki, E.F., Stimulation model for lenticular sands: Proppant transport model. Phase I annual report. Final report, 11:10965 (R;US)
See Shack, W.J., 11:11231
Ryskamp, J.M., *See* Lake, J.A., 11:11283
Ryther, J.H., Studies of marine macroalgae: saline desert water cultivation and effects of environmental stress on proximate composition. Final subcontract report, 11:11170 (R;US)

S

Sa Borges, J. de, *See* Malbouisson, A.P.C., 11:12222
Sasaki, E.W., Optical temperature sensors for transformers. Final report, 11:11771 (R;US)
Sabadell, A.J., Displacement of industrial oil consumption in developing countries by wood fuel technologies, 11:11148 (RA;PR)
Sabatini, R.L., *See* Suenaga, M., 11:11531
Saenger, W., Hydrogen bonding patterns and dynamics in biological macromolecules, 11:11946 (R;US)
See Betzel, C., 11:11697
Safa, H., *See* Bonjour, E., 11:11505
Saha, P., *See* Slovik, G.C., 11:11298
Sahm, C.C., *See* Vandenbosch, R., 11:12351
Saito, A., *See* Morse, J.W., 11:11727
Saitoh, H., *See* Kiga, T., 11:10880
Sakata, M., *See* Sato, N., 11:10838
Sakurai, T., Application of silver-free zeolites to remove iodine from dissolver off-gases in spent fuel reprocessing plants, 11:11021 (RA;XA)
Salam, A., Anomaly freedom in chiral supergravities, 11:12230 (R;IT)
Salama, C., Vegetable oils as substitutes for diesel oil, 11:11127 (RA;PR)
Salama, H.N., *See* Misak, N.Z., 11:11612
Salazar, E.A., *See* Bonzon, L.L., 11:11343
Salce, B., *See* de Goer, A.M., 11:11574
See Dubus, M., 11:11562
Saldes, F., *See* Abillon, J.M., 11:11184
Salinas, S.R.A., *See* Stilck, J.F., 11:12397
Saltelli, A., *See* Avogadro, A., 11:11068
Salzman, G.C., *See* Patterson, C.W., 11:11948
Sammells, A.F., Birefringence relaxation for semiconductor minority-carrier lifetime measurement. Final report, 11:11848 (R;US)
Sampson, D.H., *See* Clark, R.E.H., 11:12125
Samskog, P.O., Dependence of radical anion stability on crystal structure, 11:11570 (J;GB)
Samuel, A., *See* Treves, S., 11:11717
Samuel, J.E., *See* Frazier, M.E., 11:12025
Samuels, G., Food crop versus energy-crop production in the Caribbean, 11:11138 (RA;PR)
Sanchez, A.L., *See* Schell, W.R., 11:11000
Sanchez, C., *See* Sieber, K.D., 11:11598
Sandberg, V.D., Heuristic introduction to gravitational waves, 11:12419 (J;US)
Sanders, J.P., *See* Courville, G.E., 11:11419
Sanders, R.W., *See* Olsen, K.B., 11:10969
Sanderson, J.G., *See* Larsen, E.W., 11:12423

Sands, M., Emittance growth from radiation fluctuations, 11:11790 (R;US)
Sangaiah, R., *See* Nesnow, S., 11:11870
Sanghvi, A.P., *See* Levy, R.D., 11:11401
Santarius, J.F., *See* Kulcinski, G.L., 11:12493
Santoro, A.F.S., *See* Bediaga, I., 11:12180, 11:12181
See Caruso, F., 11:12178
Santoro, R.T., Monte Carlo and discrete ordinates calculations for 14-MeV neutrons streaming through a stainless steel duct: comparisons with Experiment II, 11:12498 (R;US)
Sarda, J.P., *See* Gadelle, C., 11:10747
Sarikov, N.A., *See* Bel'kov, A.A., 11:12205
Satchler, G.R., *See* Shalaby, M.M., 11:12377
Sato, K., Determination of gamma-ray peak efficiency, including correction for self-absorption, in cubic samples, 11:12380 (R;AU)
Sato, N., Preparation test of HCWS at a pilot plant in 1984, 11:10838 (RA;US)
Satterfield, C.N., Catalytic hydrotreatment studies with model compounds. Quarterly report, October 1, 1985-December 31, 1985, 11:10781 (R;US)
Sauer, A., *See* Robinson, D.G., 11:11930
Sauer, K., *See* Karukstis, K.K., 11:11695
Sauneuf, A., Soft X-ray imaging with axisymmetry microscope and electronic readout, 11:12426 (R;FR)
Savage, R.L., *See* Zronek, S.C., 11:10807
Savit, R., Morphology of a class of kinetic-growth models, 11:12417 (J;US)
Sawan, M.E., *See* Kulcinski, G.L., 11:12493
Saxton, M.J., Could phytoalexin elicitors operate by a crosslinking mechanism?, 11:11944 (RA;US)
Saykally, R.J., *See* Ray, D., 11:12096
Sazdjian, H., Relativistic wave equations for two interacting particles and zero mass bound states, 11:12192 (R;FR)
Scanlan, R., *See* Taylor, C.E., 11:11805
Schadt, W., *See* Schmidt-Boecking, H., 11:12105
Schaefer, D.H., *See* Whitfield, M.S. Jr., 11:11040
Schaefer H.F. III, *See* Clabo D.A. Jr., 11:12100
Schaffer, A.C., *See* Baltay, C., 11:12166
Schechter, D.E., *See* Baity, F.W., 11:12428
Scheimer, J.F., Seismicity rates for East Bay faults, 11:12032 (R;US)
Schelin, H.R., sup(10,11) B(p, n) sup(10,11) C reaction between E sub(p) = 13.6 and 14.7 MeV, 11:12298 (R;BR)
Schell, W.R., Investigation of siting parameters for near surface disposal of low-level nuclear waste. Final report, 11:11000 (R;US)
Schelling, G.T., *See* Sweeten, J.M., 11:11134
Schepkin, M., *See* Kobzarev, I., 11:12196
Scherpelz, R.I., *See* Desrosiers, A.E., 11:11340
Scheuerman, C.M., *See* Titran, R.H., 11:11517
Schidlovsky, G., *See* Lefevre, M.E., 11:12010
Schiffer, M., *See* Aratyn, H., 11:12233
Schirber, J.E., *See* Jones, E.D., 11:11586
Schlagel, T.J., *See* Morris, R.N., 11:12497
Schlenker, R.A., Internal emitter limits for iodine, radium and radon daughters, 11:12002 (BA;US)
Schloemer, H.J., *See* Palz, K., 11:10761
Schmid, M.R., *See* Faulkner, A.R., 11:10849
Schmidt, E.E., *See* Yamada, R., 11:11821
Schmidt, E.L., *See* Steimle, F., 11:11382
Schmidt, J., Third working meeting on radiation interaction. 1, 11:11713 (R;DD)
Third working meeting on radiation interaction. 2, 11:11714 (R;DD)
Schmidt-Boecking, H., Spectroscopy of quasimolecular X-rays with H-like decelerated ions, 11:12105 (J;NL)
See Meron, M., 11:12104
Schmitt, M., *See* Kellogg, R., 11:12149
Schmitz, U., Air-fed evaporators and condensing units, 11:11440 (RA;DE;In German)
Schmoliner, R., *See* Dudczak, R., 11:11972
Schmutz, J.D., *See* Workhoven, R.M., 11:11103
Schnitzler, B.G., TMI-2 isotopic inventory calculations, 11:11241 (R;US)
Schoch, P.M., Comparison of the radial potential profile measured in a tokamak to predictions of stochastic magnetic field theory, 11:12469 (J;US)
Schoofs, G., Adsorption and desulfurization of thiophene on nickel(111), 11:11670 (R;US)
Schoonveld, L.H., *See* Sammells, A.F., 11:11848
Schramm, D.N., Underground neutrino astronomy, 11:12176 (J;US)
See Symbalisty, E.M.D., 11:12048
Schroeder, H.A., Essential trace metals in man: molybdenum, 11:12012 (J;US)
Schroeder, R.J., *See* Shepard, C.L., 11:11532
Schubert, J.F., Atlantic Coast Unique Regional Atmospheric Tracer Experiment (ACURATE), 11:11864 (R;US)
Schuch, R., *See* Meron, M., 11:12104
See Schmidt-Boecking, H., 11:12105
Schuck, P., *See* Bilal, A., 11:12242
See Durand, M., 11:12368
Schuh, A., Dynamics of six-quark systems in the soliton bag model, 11:12361 (R;US)
See Wilets, L., 11:12225
Schuler, R.H., *See* Lefcourt, M., 11:11692
See Taniguchi, H., 11:11691
Schultz, M., Effects of whistler-mode and other waves in the magnetosphere. Final report 1981-1984, 11:12053 (R;US)
Schultz, S., *See* Gandra, F., 11:11535
Schulz, M., *See* Schmidt-Boecking, H., 11:12105
Schulz, S., *See* Steimle, F., 11:11382
Schutz, Y., *See* Fewell, M.P., 11:12120
Schwach, G.W., Report 1984. Work of the Austrian Research Center Seibersdorf in 1984, 11:11230 (R;AT;In German)
Schwander, Y., *See* Brossard, P., 11:11605
Schwandt, P., *See* Brown, R.E., 11:12289
Schwarz, K., *See* Loiseau, B., 11:12193
Schweikert, E.A., *See* Beug, M.U.D., 11:11847
See Friedli, C., 11:11609
Schweitzer, D.G., Objective of the NRC high-level research program at BNL, 11:11054 (J;US)
See Davis, M.S., 11:11053
Scott, P.V., *See* Swain, M.R., 11:11488
Scott, S., *See* Wong, K.L., 11:12464
Scott, T.K., Cell wall proteins extracted from suspension-cultured cells, 11:11931 (RA;US)
Sealock, L.J. Jr., *See* Butner, R.S., 11:11132
Seapan, M., Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)
Sears, T.J., *See* Liu, D., 11:12097
Seay, J.G., *See* Asbury, J.G., 11:11493
Sechi-Zorn, B., *See* Chang, C.Y., 11:11807, 11:12147
See Glasser, R.G., 11:12146
Seery, D.J., Kinetics of coal pyrolysis and devolatilization. Technical progress report, August 1, 1985-October 31, 1985, 11:10784 (R;US)
Sefer, N.R., Synthetic Fuel Center operation. Monthly progress report No. 2, 1-31 December 1985, 11:11502 (R;US)
Seidman, G., Distribution of sulfur in the wheat grain as shown by radioautographs, 11:12014 (J;NL)
Selan, J.L., *See* Ayoub, M.M., 11:12027
Selander, W.N., *See* Jackson, D.P., 11:12476
Selcow, E.C., Physics parameter space of tokamak ignition devices, 11:12429 (R;US)
Selkowitz, S., Window performance and building energy use: some technical options for increasing energy efficiency, 11:11454 (J;US)
Sell, C.E., Assessment of the US Department of Transportation's radioactive materials routing report, 11:10991 (R;US)
Sellin, I.A., Convoy electron production by heavy ions in solids, 11:12113 (J;NL)
See Glass, G.A., 11:12109
Seminara, J.L., *See* Pack, R.W., 11:11314
Semon, D., *See* Mihara, Y., 11:11820
Sen, B., *See* Vannice, M.A., 11:11654
Sen, D., Fermions in the space-time R x S^3, 11:12414 (J;US)
Senba, M., *See* Arseneau, D.J., 11:12091
Sepehrnoori, K., *See* MacKinnon, R.J., 11:10774
Sepulveda, J., *See* Pohl, J.H., 11:10862, 11:10863
Sepulveda, J.L., Production of coal-water slurry fuel with low-ash western bituminous coal, 11:10844 (RA;US)
Seraydarian, R.P., Multichordal charge exchange recombination spectroscopy on the Doublet III tokamak, 11:12459 (J;US)
Serrao, V.A., *See* Wolynec, E., 11:12334
Server, W.L., *See* Close, J.A., 11:11233
Seshan, K., One MeV electron irradiation of pure nickel compared to lithium-implanted nickel, 11:11540 (J;GB)
Settle, J.L., *See* Nagy, Z., 11:11366
Sexton, R., Cell wall breakdown and abscission, 11:11955 (RA;US)
See DeMason, D.A., 11:11938
Sextro, R.G., Indoor air quality: sources and control, 11:11873 (J;US)
Sezgin, E., *See* Bergshoeff, E., 11:12229
See Salam, A., 11:12230
Sha, W.T., *See* Hull, J.R., 11:11183

Shabalin, E.P., Nature of the scalar resonance delta (980), 11:12243 (R;SU)
Shack, W.J., BWR pipe crack and weld clad overlay studies, 11:11231 (R;US)
Shackelford, S.A., Deuterium isotope effects in condensed-phase thermochemical decomposition reactions of octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, 11:11694 (J;US)
Shackelford, W.M., Analysis of extractable priority pollutants in water by gas chromatography/mass spectroscopy, 11:11915 (R;US)
Shafik, S.S., *See* Misak, N.Z., 11:11612
Shah, N.K., *See* Mok, W.M., 11:11626
Shah, Y.T., *See* Holder, G., 11:11142
Shahrokhi, F., *See* Kryter, R.C., 11:11229
Shaing, K.C., Neoclassical transport fluxes in the plateau regime in nonaxisymmetric toroidal plasmas, 11:12460 (J;US)
Shalaby, M.M., Optical potential ambiguities and fusion cross sections for heavy ions, 11:12377 (J;NL)
Shan, Z.Y., Preliminary radiation protection tests for the body height and body weight of the Chinese reference man, 11:12394 (TG;US)
Shanbhag, P.M., *See* Morse, J.W., 11:11727
Shannon, L.M., *See* Herman, E.M., 11:11959
Shapira, D., Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 11:12308 (J;NL)
Shaposhnikov, M.E., *See* Kuzmin, V.A., 11:12183
Sharon, A., *See* Marciniak, T.J., 11:11446
Sharp, J.K., *See* Albersheim, P., 11:11951
Sharp, R.R. Jr., Siting, constructing, and maintaining a deep underground science laboratory, 11:12175 (J;US)
Shastri, K., *See* Baltay, C., 11:12166
Shatas, S.C., *See* Hahn, S., 11:11587
Shatrovskaya, N.A., *See* Bayukov, Yu.D., 11:11925
Shchegolev, V.A., *See* Berenyi, D., 11:12086
Shchornak, G., *See* Vagner, V., 11:11804
Shebeko, Yu.N., Theoretical evaluation of critical gas layer thickness in relation to detonation wave propagation, 11:11737 (RA;XA)
See Ivanov, A.V., 11:11735
Sheffer, G., *See* Dombsky, M., 11:12344
Shellenbarger, K., *See* Humenick, M.J., 11:10765
Shen, S.Y., *See* Vyas, A.D., 11:11158
Shepard, C.L., Raman scattering in experiments with planar Au targets irradiated with 0.53 μm laser light, 11:11532 (J;US)
Shepherd, J.E., *See* Ratzel, A.C., 11:11740
Sheth, K., *See* Starling, K.E., 11:11674
Shetty, D.K., *See* Rosenfield, A.R., 11:11553, 11:11561
Shevchenko, L.V., *See* Kondratyuk, L.A., 11:12201
Shewbridge, E.G., *See* Pack, R.W., 11:11314
Shida, Y., *See* Tanihata, I., 11:12307
Shih, C.C., *See* Motley, E.P., 11:10795
Shikiar, R., *See* Morgenstern, M.H., 11:11327
See Olson, J., 11:11335
Shillinglaw, A.J., *See* Simpson, L.A., 11:11503
Shin, D.H., *See* Kang, S.K., 11:10875
Shinozuka, M., *See* Hwang, H., 11:11225
Shirkov, D.V., Renormalizations in quantum field theory, 11:12251 (R;SU;In Russian)
Shishov, Yu.A., *See* Bartenev, V.D., 11:11745
Shiu, K.K., Containment performance evaluation for the GESSAR-II plant for seismic initiating events, 11:11293 (R;US)
Evaluation of ATWS core damage frequency for an earlier vintage BWR/4, 11:11292 (R;US)
Shivakumar, B., *See* Shapira, D., 11:12308
Shmatikov, Z.Zh., *See* Grach, I.L., 11:12197
Shoemaker, P.E., *See* Magnani, N.J., 11:11372
Shoesmith, D.W., Chemistry of nuclear fuel (UO_2) dissolution under waste disposal vault conditions, 11:11722 (RA;US)
Shomeker, K., *See* Novgorodov, A.F., 11:11720
Shriner, D.S., Acidic deposition: effects on agricultural crops. Final report, April 1980-31 December 1984, 11:12009 (R;US)
Shugart, H.H., *See* Urban, D.L., 11:11893
Shukla, A., Study of energy loss and its mechanisms in Homalite 100 during crack propagation and arrest, 11:11569 (R;US)
Shukla, S.N., Stress analysis of the ROQUEFORT diagnostic canister by finite-element method, 11:11749 (R;US)
Shul'tse, V., *See* Vagner, V., 11:11804
Shying, M.E., *See* Evans, J.V., 11:11716
Sieber, K.D., Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs, 11:11598 (J;US)
Siegel, B.Z., Impact of geothermal development on the state of Hawaii. Executive summary. Volume 7, 11:11200 (R;US)
Siegel, M.M., *See* Barone, S.P., 11:10755
Siegrist, A.E., New method of synthesizing stilbene compounds with heterocyclic substituents, anil synthesis, 11:11698 (TJ;US)
Siekhaus, W.J., *See* Balooch, M., 11:11662
Sigmar, D.J., *See* Spong, D.A., 11:12443
Sill, C.W., *See* Chiu, N.W., 11:11614
Silva, A.J. da, *See* Carvalho, C.A. de, 11:12237
Silva, E.P. da, *See* Doria, R.M., 11:12221
Silver, E.G., Nuclear Safety, Volume 25, No. 4. Technical progress review, July-August 1984, 11:11353 (R;US)
Silvestre-Brac, B., Study of light baryons in the three quark cluster model: exact calculations, 11:12195 (R;FR)
See Piepenbring, R., 11:12217
Silvey, J.F., Opportunities for biomass energy projects in the State of California, 11:11124 (RA;PR)
Simao, F.R.A., *See* Malbouisson, A.P.C., 11:12222
Simionatto, S., *See* Arruda Neto, J.D.T., 11:12352
Simmons, M.L., *See* Bucher, I.Y., 11:12522
Simoes, J.A.M., *See* Fleury, N., 11:12186
Simon, D.S., *See* Loo, B.W., 11:11979
Simon, R., *See* Murphy, K., 11:11447
Simonov, Yu.A., QCD Hamiltonian in the polar representation, 11:12244 (R;SU)
See Kalashnikova, Yu.S., 11:12198
Simonovic, J., *See* Tomasevic, M., 11:11976
Simonson, J.M., Enthalpies of dilution of aqueous calcium chloride to low molalities at high temperatures, 11:11660 (J;US)
Simovic, M., *See* Dobrilovic, L., 11:11828
Simpson, L.A., Effect of irradiation and irradiation temperature on the fracture toughness of cold-worked Zr-2.5 wt percent Nb, 11:11503 (R;CA)
Sinclair, R., *See* Mecartney, M.L., 11:11560
Sinfelt, J.H., *See* Wang, P., 11:11534
See Wang, P.K., 11:11684
Singham, S.B., *See* Patterson, C.W., 11:11948
Sirignano, W.A., *See* Aggarwal, S., 11:11729
Sirugue, M., *See* Albeverio, S., 11:12055
See Blanchard, P., 11:12400
Sirugue-Collin, M., *See* Albeverio, S., 11:12055
See Blanchard, P., 11:12400
Sistemich, K., *See* Wolf, A., 11:12327
Sites, J.R., Photoluminescence of $CuInSe_2$ photovoltaic cells. Final subcontract report, 1 April 1984-31 March 1985, 11:11167 (R;US)
Skaggs, R.L., *See* Walters, W.H., 11:11026
Skard, J.A.J., *See* Chang, C.Y., 11:12147
See Glasser, R.G., 11:12146
Sklad, P.S., *See* White, C.W., 11:11563
Sklarew, D.S., *See* Olsen, K.B., 11:10969
Skotheim, T.A., Ultra high vacuum electrochemistry with conducting polymers, 11:11701 (J;GB)
Skuja, A., Electron ring design for HERA, including spin-matching, 11:11808 (RA;US)
See Chang, C.Y., 11:11807, 11:12147
See Kellogg, R., 11:12149
See Steinberg, P., 11:12148
Skumanich, A., *See* Fournier, D., 11:11590
Skupsky, S., [Experiments on the OMEGA Laser System]. LLE Review. Quarterly report, July-September 1985. Volume 24, 11:12489 (R;US)
LLE Review. Quarterly report, April-June 1985, 11:12488 (R;US)
Skvarka, P., Reliability analysis of operating indicators of nuclear power plants, 11:11252 (RA;CS;In Slovak)
Slaby, J.G., Overview of free-piston Stirling technology at the NASA Lewis Research Center, 11:11491 (R;US)
Slaus, I., *See* Brown, R.E., 11:12289
Slichter, C.P., *See* Wang, P., 11:11534
See Wang, P.K., 11:11684
Slobodrian, R.J., Polarized ^{3}He ion source for the Van de Graaff based on the 2^3S_1 state of helium. Progress report, 11:11803 (R;CA;In French)
Slovacek, R.E., *See* Maguire, H.T., 11:12355
Slovik, G.C., RAMONA-3B application to Browns Ferry ATWS, 11:11298 (R;US)
See Rohatgi, U.S., 11:11234
Slovinskij, B., *See* Mulas, Eh., 11:12161
Slutz, S.A., *See* Swegle, J.A., 11:12502

Small, G.J., *See* Chang, T.C., 11:11688
Smallwood, D.O., Rectangular plate is proposed as an IES modal test structure, 11:11748 (R;US)
Smarsh, J.D., *See* Bright, R.W., 11:11991
Smelcerovic, M., Improved model of electron interaction with matter to be used for calculation of detector's response function, 11:11832 (RA;AT)
See Dobrilovic, L., 11:11828
Smelser, P., *See* Derrig, G., 11:11795
Smith, A.W., New gauge for supersymmetric abelian gauge theories, 11:12218 (R;BR)
See Jasinschi, R.S., 11:12041, 11:12241
Smith, B.W., Monitoring alarm resolution effectiveness, 11:11091 (J;US)
Resolving MC & A alarms from process monitoring in a fuel fabrication facility, 11:11090 (J;US)
Smith, C., *See* Minehart, R.C., 11:12293
Smith, D., *See* Albrecht, G.F., 11:11761
Smith, D.H., Evaluation of uranium and plutonium internal standards, 11:11619 (R;US)
ISPO Task A-126: application of mixed internal standards to the mass spectrometric analysis of plutonium and uranium in spent fuel dissolver solutions: ORNL results, 11:11721 (R;US)
Smith, E.D., *See* Boegly, W.J. Jr., 11:11027
Smith, E.J., *See* Tsurutani, B.T., 11:12058
Smith, F.W., Investigations of hard, carbon-based surface coatings: from "diamond-like" carbon to silicon carbide. Progress report, July 1, 1985-June 30, 1986, 11:11579 (R;US)
Smith, I.D., Study to simulate high altitude EMP surges induced in overhead power lines. Final report, 11:11856 (R;US)
Smith, J.D., *See* Culwick, B.B., 11:11783
Smith, J.E. Jr., Direct coal liquefaction using iron-titanium hydride as a hydrogen distribution and catalytic material. Progress report No. 5, September 1-November 30, 1985, 11:10786 (R;US)
Smith, J.L., *See* Gandra, F., 11:11535
See Golding, B., 11:11536
Smith, L.H., *See* Griest, W.H., 11:10919
Smith, L.R., Characterization of exhaust emissions from alcohol-fueled vehicles. Final report, 11:11498 (R;US)
Smith, M.S., *See* Desrosiers, A.E., 11:11340
See Vane, C.R., 11:12114
Smith, P.J., Detailed model for practical pulverized coal furnaces and gasifiers. Quarterly technical progress report No. 2, August 1-October 31, 1985, 11:10910 (R;US)
Smith, R., *See* Burnett, S.M., 11:12326
Smith, R.C., MELPROG analysis of the DF-1 severe core damage experiment, 11:11352 (R;US)
Smith, R.D., Pressure programming in supercritical fluid chromatography, 11:11631 (J;US)
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)
See Wright, B.W., 11:11630
Smither, R.K., *See* Kutschera, W., 11:11726
Smoot, L.D., *See* Germane, G.J., 11:10794
See Smith, P.J., 11:10910
Snellman, M., *See* Peltonen, E., 11:11037
Snow, G., *See* Chang, C.Y., 11:11807
Snow, G.A., *See* Steinberg, P., 11:12148
Snow, L.D., *See* Qin, X.Z., 11:11715
Sobotka, L.G., *See* Morrissey, D.J., 11:12346
Soderstrom, K.G., *See* Pytlinski, J.T., 11:11179
Sofield, C.J., *See* Miller, P.D., 11:12118
Solomon, A.D., Formulation of hyperbolic Stefan problems, 11:11765 (J;US)
Solomon, S.B., OECD/NEA Radon Intercalibration and Intercomparison Programme Pacific Region Intercomparison Programme, 11:12388 (R;AU)
Soloway, A.H., Chemoradiotherapy of cancer: boronated antibodies and boron-containing derivatives of promazine and porphyrins for neutron capture therapy. Progress report, November 1984-October 1985, 11:11973 (R;US)
Somboonsuk, K., The first sidebranch instability of dendritic structures, 11:11547 (J;US)
Sommer, H.T., *See* Aggarwal, S., 11:11729
Sommer, T.D., *See* Wagner, J. Jr., 11:10887
Somorjai, G.A., *See* Crowell, J.E., 11:11666
See Sieber, K.D., 11:11598
Soni, A., *See* Bengtsson, H., 11:12213
See Bernard, C., 11:12212
Sonntag, C., *See* Patigny, J., 11:10745
Sons, R.J., Example motion sensor test results using the Sandia Intruder Motion Simulator, 11:11104 (J;US)
Soroka, K.E., Excavation evaluation of the controlled burnout of an abandoned coal mine, 11:10776 (RA;US)
Sourian, J.M., Universe symmetries, 11:12039 (R;FR;In French)
Southworth, F., Study of current and planned high occupancy vehicle lane use: performance and prospects, 11:11462 (R;US)
Souza, M.H.G., *See* Bediaga, I., 11:12180, 11:12181
See Caruso, F., 11:12178
Sozer, A., MELRPI - development and use, 11:11301 (R;US)
Spaletta, H.W., *See* Close, J.A., 11:11233
Spaletto, M.I., *See* Legeled, M.A., 11:11097
Spane, F.A. Jr., HEADCO: a program for converting observed water levels and pressure measurements to formation pressure and standard hydraulic head, 11:12030 (R;US)
Spanner, G.E., *See* Westsik, J.H. Jr., 11:11028
Spear, R.H., *See* Burnett, S.M., 11:12326
Spence, K., *See* Porter, R., 11:10931
Spencer, F.S., *See* Dunstall, T.G., 11:11899
Spettell, C.M., *See* O'Brien, J.N., 11:11329
Spinedi, C., Measurements on 2 test cabins, one with glazed veranda and one with direct energy gain, 11:11186 (RA;CH;In German)
Spitzka, R.E., *See* Vigil, S.A., 11:11126
Spong, D.A., Effects of an alpha particle slowing-down distribution on tokamak ballooning modes, 11:12443 (R;US)
Spyrou, S.M., *See* Hunter, S.R., 11:11770
Srdoc, D., Microdosimetry of gamma and neutron radiation. State-of-the-art and recent experimental data, 11:12390 (RA;AT)
Srivastava, S. C., Tin-117M-labeled stannic (SN^{4+}) chelates, 11:11982 (P;US)
Srolovitz, D.J., *See* Anderson, M.P., 11:11546
St. John, L., *See* Abegglen, F., 11:11799
Stacey, F.D., *See* Fowler, W.A., 11:12177
Stadlbauer, J.M., Muonium addition reactions to aromatic solutes. Application of the Hammett equation in the production of muonium-radicals, 11:12090 (R;CA)
Stalker, A.E., *See* Henscheid, J.W., 11:11014
Stanicek, J., Event tree and its application in analysis of nuclear power plant operating states, 11:11228 (RA;CS;In Czech)
Stapp, H.P., *See* Kawai, Takahiro, 11:12267
Stark, D.J., *See* Simpson, L.A., 11:11503
Starkel, W.M., Predicting the effect of macro-benthos on the sediment/water flux of metals and phosphorus, 11:11912 (J;CA)
Starling, K.E., Thermophysical properties correlations and pseudocomponent characterization parameter estimation for fossil fluids. First quarterly report (III year), September 1-November 30, 1985, 11:11674 (R;US)
Staskawicz, B.J., *See* Keen, N.T., 11:11964
Stauffer, T.R., Breeder reactor economics, 11:11265 (R;US)
Stearns, J.W., Negative-lithium emission from a tungsten surface in a plasma, 11:12119 (J;US)
Stecker, F.W., Galactic antiprotons from photinos, 11:12047 (J;US)
Steer, M.W., Control of cell wall formation in pollen tubes: the interaction of dictyosome activity with the rate of tip extension, 11:11962 (RA;US)
Steffen, K., *See* Skuja, A., 11:11808
Steimle, F., Refrigeration technology laboratories introduce themselves, 11:11382 (RA;DE;In German)
Stein, H.J., *See* Hahn, S., 11:11587
Steinberg, P., Deep inelastic muon scattering at Fermilab - status report, 11:12148 (RA;US)
See Chang, C.Y., 11:11807
Steinberg, R.I., *See* Cherry, M.L., 11:12174
Stek, M., Murine immunization by cesium-137 irradiation attenuated Schistosoma mansoni cercariae, 11:11992 (R;US)
Stelbovics, A.T., *See* Mitroy, J., 11:12081
Stelson, P.H., *See* Shapira, D., 11:12308
Stelte, N., Importance of the source term for the release of radionuclides from a repository in a salt dome, 11:11062 (RA;US)
Stephens, D.R., *See* Hill, R.W., 11:10744
Stephens, F.S., *See* Macchiavelli, A.O., 11:12321
See Tjom, P.O., 11:12339
Stephens, J.R., *See* Titran, R.H., 11:11517

Stephens, R.W., Precautionary labeling of petroleum products in packages - a labeling system, 11:10954 (R;US)
Stevens, D.E., *See* Hanna, A.F., 11:11862
Stevens, W.J., *See* Krauss, M., 11:11639
Stewart, D.B., Research oriented technological needs in the Sydney coalfield, 11:10818 (R;CA)
Stewart, D.K., *See* Greene, E.F., 11:11667
Stewart, D.L., *See* Wright, C.W., 11:10927, 11:10928
Stewart, J.J. Jr., *See* Rognlien, T.D., 11:12456
Stewart, L.E., *See* Walkowiak, W., 11:11627
Stickford, G.H., *See* Razgaitis, R., 11:11413
Stigsson, L.L., Fluid Carbon fuel production and utilization in Sweden, 11:10840 (RA;US)
Stilck, J.F., Phenomenological renormalization group calculations for 12- and 16- vertex models on a square lattice, 11:12397 (R;BR)
Stinton, D.P., Fabrication of ceramic-ceramic composites by chemical vapor deposition, 11:11568 (J;US)
Stirling, W.L., *See* Tsai, C.C., 11:12479
Stocker, H., Recommendations concerning an interim annual individual exposure limit for respirable quartz, 11:11077 (R;CA)
Stoecker, H., *See* Cusson, R.Y., 11:12306
Stoenner, R.W., *See* Glaros, D., 11:11980
Stoffel, J.W., Conformance to Regulatory Guide 1.97, Catawba Nuclear Station, Unit Nos. 1 and 2 (Docket Nos. 50-413 and 50-414), 11:11261 (R;US)
Stoke, H.W., Recombinant genetic approaches for efficient ethanol production, 11:11145 (BA;US)
Stone, B.A., Noncellulosic β-glucans in cell walls, 11:11952 (RA;US)
Stopa, C.R.S., *See* Maguire, H.T., 11:12355
Storck, R., *See* Stelte, N., 11:11062
Stork, D.H., *See* Bengtsson, H., 11:12213
Storm, D.W., Superconducting tests of beta = 0.1 and beta = 0.2 resonators, 11:11802 (R;US)
Strachan, D.M., Results from the long-term interaction and modeling of SRL-131 glass with aqueous solutions, 11:11060 (R;US)
Strachan, J.D., *See* Wong, K.L., 11:12464
Stratton, R.C., *See* Lindsay, R.W., 11:11277
Strayer, M.R., *See* Cusson, R.Y., 11:12306
Streeter, R.C., Evaluation of the effect of coal cleaning on fugitive elements. Phase IV. Identification of mineral forms in coal. Quarterly progress report No. 10, September 1-November 30, 1985, 11:10825 (R;US)
Streett, W.B., *See* Rubio, R.G., 11:11677
Strickler, D.J., *See* Peng, Y.K.M., 11:12442
Strittmatter, R.B., *See* Cooley, J.N., 11:10982
Strohm, W.W., Demonstration of the calorimetric assay of large mass, high burn-up PuO_2 samples, 11:11107 (J;US)
Strojan, C.L., Ecological research at the Savannah River Ecology Laboratory. Annual report for the period ending July 31, 1985, 11:11921 (R;US)
Strong, D.M., *See* Pellet, S., 11:11988
Strong, J.E., *See* Benziger, J.B., 11:11780
Strugalski, Z., Stopping and energy deposition of hadrons in target nuclei, 11:12383 (R;SU)
Stuart, N.J., System for gathering dragline data using an electronic data logger and modem, 11:10817 (R;CA)
Stubican, V.S., Influence of anisotropy and doping on grain boundary diffusion in oxide systems, 11:11566 (J;NL)
Stuchbery, A.E., *See* Poletti, A.R., 11:12341
Studley, R.V., Safeguarding NDA systems, 11:11106 (J;US)
Stuetzer, O.M., *See* Bonzon, L.L., 11:11343
Stwertka, P.M., *See* Coimbra, M.M., 11:12313
See Toledo, A.S. de, 11:12314
Suchomel, J., Information analysis and dissemination system of safety significant nuclear power plant failures, 11:11322 (RA;CS;In Slovak)
Suenaga, M., Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
Sugimoto, K., *See* Tanihata, I., 11:12307
Sugiyama, H., *See* Naka, A., 11:10839
Suidan, M.T., Anaerobic treatment of gasifier effluents. Final report, 11:10803 (R;US)
Sukhovoj, A.M., *See* Popov, Yu.P., 11:12335
Sulik, B., *See* Berenyi, D., 11:12086
Sullivan, B.P., Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
See Allen, G.H., 11:11176
See Caspar, J.V., 11:11668
See Neyhart, G.A., 11:11175
Sullivan, J.P., Efficiency and response of the total energy counter, 11:11819 (RA;US)
Summers, D.A., *See* Mazurkiewicz, M., 11:10832
Summers, W.R., *See* Beug, M.U.D., 11:11847
Sun, T., VPI-3 alkali attack of coal gasifier refractory linings. Progress report No. 4, October 1-December 31, 1985, 11:10779 (R;US)
Sundell, S., *See* Ravn, H.L., 11:12065
Susman, S., Transport mechanisms in β-lithium/aluminum: an overview, 11:11367 (R;US)
Suter, G.W., *See* Vo-Dinh, T., 11:11689
Suter, G.W. II, *See* Jones, T.D., 11:10922
Sutherland, B.M., *See* Moore, S.P., 11:11963
Sutrick, J.S., *See* Rybicki, E.F., 11:10965
Suvorov, V.M., *See* Bystritskij, V.M., 11:12087
Suzuki, N., *See* Sato, N., 11:10838
Sviatoslavsky, I.N., *See* Kulcinski, G.L., 11:12493
Swain, M.N., *See* Swain, M.R., 11:11488
Swain, M.R., Waste heat recovery in a 1600 cc methanol fueled engine, 11:11488 (R;US)
Swan, S.A., Rollover protective structures (ROPS) inspection and maintenance guide. Information circular/1985, 11:10923 (R;US)
Swanson, B.I., *See* Jones, L.H., 11:11655
Sweeten, J.M., Grain sorghum stillage processing: nutrient recovery and pollution control, 11:11134 (RA;PR)
Swegle, J.A., Current neutralization of intense light ion beams in argon gas, 11:12502 (R;US)
Swindle, D.W., *See* Cooley, J.N., 11:10982
Swinth, K.L., Factors affecting the assessment of lung depositions of transuranics, 11:12000 (R;US)
Swisher, J.H., Status of electric vehicle battery development and manufacturing activities outside of the United States, 11:11494 (R;US)
Sydora, R.D., Dynamics and fluctuation spectra of electrostatic resistive interchange turbulence, 11:12437 (R;US)
Symbalisty, E.M.D., Expanding vortex site for the r-process in rotating stellar collapse, 11:12048 (J;US)
Symons, T.J.M., *See* Gould, H., 11:12116
Syrett, B.C., Seminar proceedings: prevention of condenser failures - the state of the art, 11:11215 (R;US)
Szabo, P.P., *See* Ranogajec-Komor, M., 11:11825
Szanto, E.M., *See* Carlin Filho, N., 11:12299
Szirtes, L., Effect of gamma radiation on various inorganic ion exchangers, 11:11712 (RA;XA)
Szymanski, Z., *See* Piepenbring, R., 11:12217

T

Taback, H.J., Alkaline and Stretford scrubbing tests for H_2S removal from in-situ oil retort offgas. Final report, February 1983-February 1985, 11:10968 (R;US)
Tabata, A., *See* Hiraguri, T., 11:12525
Taernfors, E., Flexible approach to expanding production capacity for Nycol, 11:10842 (RA;US)
Taguchi, S., *See* Hiraguri, T., 11:12525
Talt, G., *See* Wong, K.L., 11:12464
Talt, J.C., *See* Gray, M.N., 11:11067
Taiz, L., Regulation of cell wall mechanical properties in vivo and in vitro, 11:11983 (RA;US)
Tajima, T., *See* Eliezer, S., 11:12494
Takahashi, A., *See* Sakurai, T., 11:11021
Takahashi, K., *See* Kiga, T., 11:10880
Takahashi, N., *See* Tanihata, I., 11:12307
Takano, N., *See* Sato, K., 11:12380
Takemoto, B.K., *See* Shriner, D.S., 11:12009
Talaga, R., *See* Steinberg, P., 11:12148
Talaga, R.L., Parity violation in p-p and p-nucleus scattering at LAMPF, 11:12152 (RA;US)
See Krakhauer, D.A., 11:12150
Talbert, S.G., *See* Razgaitis, R., 11:11413
Taniguchi, H., ESR study of the dissociation of hydroxyl protons in hydroxycyclohexadienyl radicals, 11:11691 (J;US)

Tanihata, I., Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Tanner, W., Regulation of glycoprotein synthesis in yeast by mating pheromones, 11:11926 (RA;US)
Tantekin, S.B., Use of post-burn coring data from the Hanna III field test to infer the spalling characteristics, water influx and heat losses, 11:10770 (RA;US)
Tarvin, J.A., *See* Shepard, C.L., 11:11532
Tataronis, J.A., *See* Berk, H.L., 11:12436
Taverny, P., *See* Abillon, J.M., 11:11184
Taylor, A., Current research using the ANL High Voltage Electron Microscope Tandem Accelerator facility, 11:11544 (J;NL)
Taylor, A.D., *See* Liapis, K., 11:11676
See Tomkinson, J., 11:11656
Taylor, B.E., *See* Wagner, J. Jr., 11:10887
Taylor, C.E., 6.4 Tesla dipole magnet for the SSC, 11:11805 (R;US)
Taylor, G.E. Jr., *See* Shriner, D.S., 11:12009
Taylor, R.T., Mutagen formation in a model beef boiling system. III. Purification and identification of three heterocyclic amine mutagens-carcinogens, 11:12011 (J;US)
Temesi, A., *See* Pellet, S., 11:11988
Temkin, R.J., *See* Danly, B.G., 11:11777
Tepel, R.C., *See* Bjornstad, D.J., 11:11133
Ter-Martirosyan, K.A., *See* Veselov, A.I., 11:12202
Ternot, A., *See* Gadelle, C., 11:10747
Tesche, F.M., *See* Smith, I.D., 11:11856
Tetenbaum, M., *See* Ohse, R.W., 11:11538
Thacker, H.B., *See* Mackenzie, P.B., 11:12214
Thaler, J., Potential model for quark confinement, 11:12253 (R;CA)
Thambimuthu, K.V., *See* Bennett, A., 11:10881
Thayer, W.L., *See* Bennett, A., 11:10881
Theisen, H.M., *See* Vigil, S.A., 11:11126
Thelen, M., *See* Delmer, D.P., 11:11927
Thibaud, J.P., *See* Chemin, J.F., 11:12317
Thieberger, P., *See* Gould, H., 11:12116
Thianes, G.L., Analytical and experimental comparisons of modal properties of a flood water storage tank, 11:11303 (R;US)
Thode, H.C. Jr., Model of the use of coal, gas, and oil, 11:11398 (J;GB)
Thomas, E.D., *See* Schell, W.R., 11:11000
Thomas, J.T., Introduction to panel on "Where do we go from here", 11:11268 (R;US)
Thomas, M.T., *See* Baer, D.R., 11:11621
Thomas, R.H., Dosimetric aspects, 11:12003 (BA;US)
Thomaz, M.T., *See* Menezes Franca, H. de, 11:12405
Thome, F.V., *See* Bonzon, L.L., 11:11343
Thompson, J.K., Elution of benzene and methyl ethyl ketone from charcoal beds by continued air sweeping. Interim report, March 1983-November 1984, 11:11782 (R;US)
Thompson, T.W., *See* MacKinnon, R.J., 11:10774
Thomsen, M.F., *See* Gary, S.P., 11:12057
Thomson, W.W., *See* Herman, E.M., 11:11959
Thordarson, W., *See* Whitfield, M.S. Jr., 11:11040
Thorne, R.M., *See* Tsurutani, B.T., 11:12058
Thornton, S.T., *See* Shapira, D., 11:12308
Thorsness, C.B., *See* Hill, R.W., 11:10744
Thresher, R.W., Current methods for the dynamic analysis of horizontal axis wind turbines, 11:11209 (J;US)
Tichy, J.A., Performance of the RPI Passive Solar Visitors Information Center Building for 1982, 11:11190 (R;US)
Tien, C.L., *See* Reed, J.G., 11:11312
Tierney, J.W., *See* Holder, G., 11:11142
Tierney, M.S., *See* Braithwaite, J.W., 11:11064
Tikoo, S.K., *See* Ahmad, M., 11:12129
Timm, R.E., An activated barrier for protection of special nuclear materials in vital areas, 11:11102 (J;US)
Tiomno, J., *See* Bediaga, I., 11:12180, 11:12181
Tipton, I.H., *See* Schroeder, H.A., 11:12012
Titran, R.H., Creep rupture behavior of Stirling engine materials, 11:11517 (R;US)
Tjom, P.O., Slow and fast high-spin sequences in ^{168}Er, 11:12339 (J;US)
Toba, Y., *See* Sullivan, J.P., 11:11819
Todorovic, M., Tritiated waste water fixation of solid materials. Final report for the period 1 September 1982-31 August 1985, 11:11018 (R;XA)
Toland, R. H., *See* Kulkarni, S. V., 11:11495
Toledo, A.S. de, ^{24}Mg yrast sequence up to 30 MeV excitation, 11:12314 (R;BR)
See Carlin Filho, N., 11:12299
See Coimbra, M.M., 11:12313
Toledo Piza, A.F.R. de, *See* Nemes, M.C., 11:12406
Tomasevic, M., Evaluation of radiation risk resulting from diagnostic procedures that involve radionuclides, 11:11976 (RA;AT)
Tomasko, D., Effective heat transfer in the Strategic Petroleum Reserve porous media, 11:10956 (R;US)
Tomazic, W.A., Stirling engine supporting research and technology, 11:11492 (R;US)
Tomimura, A., Isotope separation in a rotational plasma, 11:12472 (TJ;AU)
Tomkinson, J., Inelastic neutron scattering spectrum of chromous acid at high energy transfers, 11:11656 (J;US)
Tong, G.T., *See* Wood, B.J., 11:10741
Tong, W.G., New laser spectroscopic technique for stable-isotope ratio analysis, 11:11636 (D;US)
Tool, G., *See* Calvo, O., 11:11809
Tost, M.P., *See* Roman, E., 11:11519
Totenbier, R.E., *See* Levine, S.H., 11:11281
Toth, L.M., Assessment of photochemical applications to specific stages in Savannah River Plant actinide reprocessing streams, 11:10988 (R;US)
Toulhoat, P., Experimentation and modelling of U, Th, and lanthanides transport in fissured rocks. Influence of complexation, 11:11057 (R;FR)
Tourangeau, P.C., Fluoride emissions of coal-fired power plants and their impact upon plant and animal species, 11:10812 (J;US)
Touret, A., *See* Antonini, G., 11:10826
Townes, B.M., *See* Jackson, D.P., 11:12476
Tracy, J.G., *See* Bell, W.A., 11:11113
Traub, R.J., *See* Swinth, K.L., 11:12000
Travis, S.B., Ingredients of deterrence. Student paper, 11:11387 (R;US)
Treado, P.A., *See* Brown, R.E., 11:12289
Treves, S., Detection and quantitation of left-to-right shunting by iridium-191m angiography, 11:11717 (R;US)
Tribble, R., *See* Mihara, Y., 11:11820
Tribble, R.E., *See* Gagliardi, C.A., 11:11787
Trimble, J.L., *See* Wright, L.L., 11:11163
Trivedi, R., *See* Somboonsuk, K., 11:11547
Trucco, H.A., Piston engine for coal-water slurry fuel, 11:10883 (RA;US)
Truemper, H., Heat recovery in an air-breakdown system with the use of waste heat for indoor heating and industrial heat, 11:11472 (RA;DE;In German)
Truhlar, D.G., *See* Blais, N.C., 11:12059
See Garrett, B.C., 11:11640
See Tucker, S.C., 11:12062
Tsai, C.C., ORNL facilities for testing first-wall components, 11:12479 (R;US)
Tsallis, C., Ondulators and Wigglers - Theoretical aspects, 11:11794 (R;BR;In Portuguese)
Tsan, M.F., *See* Wagner, H.N., 11:11984
Tschirf, E., *See* Viragh, E., 11:11278
Tschurlovits, M., *See* Hofmann, W., 11:12520
Tse, E., *See* Chong, C.Y., 11:11210
Tserruya, I., *See* Meron, M., 11:12104
See Schmidt-Boecking, H., 11:12105
Tsokos, K., *See* Damgaard, P.H., 11:12215
Tsong, I.S.T., Mechanisms of excitation and ionization processes in sputtering. Final report, 1 September 1981-28 February 1985, 11:12060 (R;US)
Tsuchimoto, T., *See* Hiraguri, T., 11:12525
Tsurutani, B.T., Observations of the right-hand resonant ion beam instability in the distant plasma sheet boundary layer, 11:12058 (J;US)
Tsyganov, S.A., *See* Borisov, A.A., 11:11736
Tucker, S.C., Variational-transition-state theory with least-action tunneling calculations for the kinetic isotope effects in the $Cl+h_3$ reaction: tests of extended-leps, information-theoretic, and diatomics-in-molecules potential energy surfaces, 11:12062 (R;US)
Tunbrant, S., *See* Abelin, H., 11:11903
Turner, J.E., *See* Sieber, K.D., 11:11598
See Wright, H.A., 11:12389
Turner, S.J., *See* Mills, B., 11:10872
Tycko, R., *See* Barbara, T.M., 11:12124
Tylka, A.J., *See* Chang, C.Y., 11:12147

U

Uckan, N.A., *See* Selcow, E.C., 11:12429
Udseth, H.R., *See* Smith, R.D., 11:11620
Uhl, J.E., *See* Romero, C.A., 11:10971
Uhler, R.G., NERC summary load forecasts: a retrospective appraisal and technical analysis. Final report, 11:11400 (R;US)

Umberger, D.K., Hausdorff dimensions for sets with broken scaling symmetry, 11:12420 (R;US)
Umiastowski, K., Processing of gamma-ray spectrometric logs, 11:11849 (R;FR;In French)
Umrigar, C., *See* Gupta, R., 11:12252
Urban, D.L., Linkages in hierarchical models, 11:11893 (R;US)
Uziel, M., Analysis of pseudouridine by fluorescence spectrometry, 11:11678 (J;US)

V

Vagner, V., Curved crystal spectrometer of Johansson type, 11:11804 (RA;SU;In Russian)
Valdez, G.D., *See* Nelson, L.S., 11:11349
Vampola, A.L., *See* Schultz, M., 11:12053
Van Buskirk, R.G., *See* Nimick, F.B., 11:12033
van de Laar, J., *See* Ronchi, C., 11:11258
van Dyck, O.B., *See* Bonner, B.E., 11:12171
Van Geem, M.G., Calibrated hot box test results data manual. Volume II. Final report, 11:11448 (R;US)
Van Hare, D.R., Analysis of special recovery samples by Pu(III) spectrophotometry, 11:11611 (R;US)
Van Hook, R.I. Jr., Assimilation and biological turnover of cesium-134, iodine-131, and chromium-51 in brown crickets, Acheta domesticus (L.), 11:12013 (J;US)
Van Luik, A.E., *See* Apted, M.J., 11:11066
Van Ryswyk, H., *See* Carpenter, M.K., 11:11571
Vandenbosch, R., Anomalously broad spin distributions in sub-barrier fusion reactions, 11:12351 (R;US)
Vane, C.R., Ultrahigh-resolution studies of heavy-ion induced X-ray satellite emission, 11:12114 (J;NL)
See Rosseel, T.M., 11:12115
Vannice, M.A., Metal-support effects on H_2 and CO heats of adsorption on TiO_2-supported platinum, 11:11654 (J;US)
Varga, D., *See* Berenyi, D., 11:12086
Varner, J.E., *See* Cooper, J.B., 11:11953
Varshneya, N.C., *See* Jagadeesh, A., 11:11204
Vashishta, P., Use of computer simulation technique to study atomic migration in solids, 11:11577 (R;US)
Vasilik, D. G., *See* Waechter, D. A., 11:11838
Vaughan, D., X-Ray Data Booklet. Center for X-Ray Optics, 11:12385 (R;US)
Vegh, J.A., *See* Berenyi, D., 11:12086
Vejvodova, I., *See* Kolesa, K., 11:11250
Vekic, B., *See* Ranogajec-Komor, M., 11:11825
Velguth, G., Practical experiences with rape-seed oil ester as fuel for tractors, 11:11501 (RA;DE;In German and English)
Venkataramani, B., *See* Iyer, R.M., 11:11647
Ventura, I., *See* Bertolami Neto, O., 11:12040
See Carvalho, C.A. de, 11:12237
Verdon, C.P., *See* Delettrez, J., 11:12485
Veresh, I., Facility for studying the cross sections of relativistic nuclear fragment strong interactions at the Dubna synchrophasotron, 11:11833 (RA;SU;In Russian)
Vernetson, W.G., University of Florida training reactor. Annual progress report, September 1, 1984-August 31, 1985, 11:11282 (R;US)
Veselov, A.I., Production and decay of quark-gluon strings: inclusive distributions of hadrons in psub(tr) and x, 11:12202 (R;SU)
See Kalashnikova, Yu.S., 11:12198
Vesely, W.E., *See* Wagner, D.P., 11:11313
Vialard, E., Behaviour of palladium in the Purex process, 11:10983 (R;FR)
Viano, J.B., *See* Kox, S., 11:12302
Vick, A., Some thoughts on deterrence, 11:11388 (R;US)
Vigil, S.A., Use of appropriate technologies for biomass waste conversion in small communities, 11:11126 (RA;PR)
Villedieu, M., Study of the thermal annealing of γ-irradiation effects in Al_2O_3: Mn, 11:11554 (R;FR)
Vineyard, T.A., *See* Hamblin, D.M., 11:11375
Vinh Mau, R., Static baryon-baryon potential in the Skyrme model, 11:12158 (R;FR)
See Lacombe, M., 11:12191
Vinson, J.W., *See* Moore, T.I., 11:11226
Viragh, E., Monitoring of airborne radioactivity at Austrian and Hungarian nuclear training reactors, 11:11278 (RA;AT)
See Feher, S., 11:11279
Visser, W., *See* Britten, J.A., 11:10763
Vitenko, V.A., *See* Blinov, M.V., 11:12354
Vo-Dinh, T., Phosphorescence line narrowing of coronene and phenanthrene adsorbed on cellulose substrates, 11:11689 (J;US)
Surface-enhanced Raman spectroscopy: a new tool for chemical detection, 11:11608 (R;US)
See Uziel, M., 11:11678
Vogt, E., Recent achievements in meson sciences at TRIUMF, 11:12164 (R;CA)
Voisine, D.C., *See* Slobodrian, R.J., 11:11803
Volin, K.J., *See* Susman, S., 11:11367
Volk, B.G., Effects of acid precipitation on a typical quartzipsamment soil in Florida, 11:11896 (R;US)
Volkov, V.Ya., *See* Bartenev, V.D., 11:11745
Vollmer, A., Round-table discussion: -18°C in the food industry, 11:11469 (RA;DE;In German)
Volltrauer, H., *See* Delahoy, A.E., 11:11166
Volodina, T.N., *See* Bayukov, Yu.D., 11:11925
Voloshin, M.B., Quantum decay rate of metastable phase in (1 + 1) dimensions, 11:12408 (R;SU)
Vondy, D.R., *See* Worley, B.A., 11:11287
Vopatril, M., *See* Stanicek, J., 11:11228
Vries, H. de, Use of ice storage equipment in the food industry, 11:11466 (RA;DE;In German)
Vukcevic, M., *See* Miric, L., 11:12391
Vyas, A.D., Economic analysis method for short-rotation forestry, 11:11158 (RA;PR)

W

Waber, J.T., *See* Kunz, A.B., 11:12061
Wadsworth, J., Superplastic properties of an Al-Cu-Li-Zr alloy, 11:11542 (J;GB)
Waechter, D. A., Portable neutron spectrometer and dosimeter, 11:11838 (P;US)
Wagner, D.P., Risk-based evaluation of technical specifications, 11:11313 (R;US)
Wagner, H.N., Radiometric methods for rapid diagnosis of viral infection. Annual report, 1 February 1976-31 January 1977, 11:11984 (R;US)
Wagner, J. Jr., Coal-water mixture firing in an industrial package boiler: a user's perspective, 11:10887 (RA;US)
Wagner, J.S., *See* Freeman, J.R., 11:12094
Wagner, R., Comparative studies of the dose-response relationship of radiation-induced chromosomal aberrations in human lymphocytes induced by low radiation doses, using Feulgen orcein glacial acetic acid and FPG staining, 11:11996 (R;DE;In German)
Wagner, S., *See* Glasser, R.G., 11:12146
Wai, C.M., *See* Mok, W.M., 11:11626
Walbert, G.F., *See* Fu, Y.C., 11:10886
Wald, J.W., *See* Weber, W.J., 11:11046
Walden, P.L., *See* Ziegler, W., 11:12305
Walker, B.E., *See* Thompson, J.K., 11:11782
Walker, D.C., *See* Stadlbauer, J.M., 11:12090
Walker, M.A., Transmission measurements of selected liquids in the far infrared, 11:12445 (R;US)
Walker, R.I., *See* Brook, I., 11:11990
See Gruber, D.F., 11:11989
Walker, R.L., *See* Smith, D.H., 11:11619, 11:11721
Walkowiak, W., Competitive solvent extraction of alkaline-earth cations into chloroform by lipophilic acyclic diionizable polyethers, 11:11627 (J;US)
Walrafen, G.E., *See* Holmes, N.C., 11:12136
Walsh, P.J., *See* Jones, T.D., 11:10922
Walsh, T.F., *See* Stecker, F.W., 11:12047
Walsh, W.J., *See* Asbury, J.G., 11:11493
Walters, E.A., Structure and thermochemistry of the van der Waals molecule C_6H_6xHCl and its photoion $(C_6H_6xHCl)^+$, 11:11679 (J;US)
Walters, W.H., Protection of uranium tailings impoundments against overland erosion, 11:11026 (R;US)
Walton, O.R., Lawrence Livermore National Laboratory Granular Flow Project. Quarterly report, October-December 1985, 11:11764 (R;US)
Wampler, J.A., *See* Dippold, D.G., 11:11056
Wang, C.Y., *See* Herrmann, R.B., 11:11854
Wang, E., Lithium insertion in $V_3Nb_9O_{28}$. A Wadsley-Roth type phase.

Technical report, June 1984-July 1985, 11:11361 (R;US)
Wang, G.C., *See* Wendelken, J.F., 11:11506
Wang, P., Observation of isolated carbon atoms and the study of their mobility on Pt clusters by NMR, 11:11534 (J;US)
Wang, P.K., Structure and reactions of C_2H_4 adsorbed on small Pt clusters, 11:11684 (J;US)
Wang, Y.S., Combustion of coal water slurry in a gas turbine combustor, 11:10882 (RA;US)
Wang, Y.T., *See* Suidan, M.T., 11:10803
Wang, Z., Advance of SSCT's CWF project in China, 11:10833 (RA;US)
See Xie, M., 11:10889
Wang Yuzhu, To test photon statistics by atomic beam deflection, 11:12083 (R;IT)
Wanyun, Z., *See* Doria, R.M., 11:12219
Ward, B., Biodegradation and bioconversion of coals by fungi. Quarterly progress report No. 1, October 1-December 31, 1985, 11:10787 (R;US)
See Wadsworth, J., 11:11542
Ward, T.E., *See* Dombsky, M., 11:12344
Warn, T., *See* Anderson, E., 11:12026
Warner, D.D., *See* Wolf, A., 11:12327
Warwick, J.E., *See* Nelson, B.E., 11:12481
Was, G.S., *See* Rote, D.M., 11:10997
Wasserman, H.J., *See* Kubas, G.J., 11:11657
Watkins, J.G., Infrared thermography of first wall components on TMX-U, 11:12501 (R;US)
Watkins, P.A., *See* Neyhart, G.A., 11:11175
Watkins, R.M., Oak Ridge National Laboratory Institutional Plan, FY 1986-FY 1991, 11:12514 (R;US)
Watling, H.E., *See* Bowman, B.R., 11:11354
Watson, J.S., Potential resources from coal fly ash, 11:10806 (J;US)
See DeMuth, S.F., 11:11763
Watson, R.L., *See* Bandong, B., 11:12075, 11:12076
See Demarest, J.A., 11:11816, 11:12074
See Palinkas, J., 11:12070, 11:12071, 11:12072, 11:12073
See Pedrazzini, G.J., 11:11815
Watts, H.A., RDEAM: an Adams ODE code with root solving capability, 11:12523 (R;US)
Weakliem, H.A., *See* Delahoy, A.E., 11:11166
Webb, T. III, Model validation research: comparison of simulated and observed climate patterns for the past 18,000 years. Progress report, February 1, 1985-January 31, 1986, 11:11858 (R;US)
Weber, E.T., *See* Pitner, A.L., 11:11315
Weber, M., *See* Lynn, K.G., 11:11114
Weber, W.J., Effects of α-radiolysis on leaching of a nuclear waste glass, 11:11046 (J;US)
See Fahey, J.A., 11:11651
Wegner, H., *See* Gould, H., 11:12116
Weidhuner, D.D., *See* Oelrich, I.C., 11:11457
Weil, D., *See* Horwitz, G., 11:12045
Weimer, W.C., *See* Wright, C.W., 11:10928
Weingart, J.M., Cost Data Management System. CDMS Version 2.2. Final report, 11:11155 (R;US)
Cost Data Management System User's Guide supplement. CDMS Version 2.2, 11:11156 (R;US)
Weiss, I., Electromagnetic wave propagation in relativistic magnetized plasmas, 11:12467 (J;US)
Weiss, L.H., Delivering coal without the dust and noise, 11:10848 (RA;US)
Weisser, H., *See* Harz, H.P., 11:11117
Weisz, C., *See* Zarand, P., 11:11826
Weitekamp, D.P., *See* Barbara, T.M., 11:12124
Welbourne, M.C., *See* Allen, J.W., 11:10865
Welch, D.O., *See* Suenaga, M., 11:11531
Welch, G.E., *See* Chang, C.Y., 11:12147
Welles, B.W., *See* Sell, C.E., 11:10991
Wells, J.C., *See* Fewell, M.P., 11:12120
Wells, R.P., Effect of oxygen concentration on the corrosion of molybdenum in flowing water, 11:11788 (R;US)
Wendelken, J.F., Hydrogen-induced reconstruction of stepped W(001) surfaces studied with LEED and EELS, 11:11506 (R;US)
Wenzel, C.R., *See* Wright, L.L., 11:11163
Wenzel, W., *See* Fowler, W.A., 11:12177
Werth, J.-E., Conformal group actions and Segal's cosmology, 11:12043 (R;BR)
Wesselhoft, R.D., *See* Euker, C.A. Jr., 11:10737
West, C.A., Pectic fragments of plant cell walls as mediators of stress responses, 11:11934 (RA;US)
Westbrook, F., *See* Southworth, F., 11:11462
Westermark, T., *See* Forberg, S., 11:11024
Westley, R.R., *See* Matthews, T.G., 11:11865
Westsik, J.H. Jr., Instrumentation for remote monitoring and control of liquid-fed ceramic melters, 11:11028 (R;US)
Wetzstein, M., *See* Keren, M., 11:10834
Weygand, D.P., *See* Chung, S.U., 11:12140
Whaley, H., Coal-water fuel developments in eastern Canada: the Chatham and Charlottetown demonstrations and beyond, 11:10891 (RA;US)
Whiddon, C.S., *See* Gagliardi, C.A., 11:11787
Whiddon, S., *See* Mihara, Y., 11:11820
White, A., *See* Landry, G., 11:10845
White, C.W., Formation of amorphous layers in Al_2O_3 by ion implantation, 11:11563 (J;NL)
See Oliver, W.C., 11:11556
White, E.L., *See* Razgaitis, R., 11:11413
White, M.G., *See* Walters, E.A., 11:11679
White, R.B., Feedback control of resistive instabilities, 11:12449 (R;US)
White, T.L., *See* Bigelow, T.S., 11:12484
Whitfield, M.S. Jr., Geohydrology of rocks penetrated by test well USW H-4, Yucca Mountain, Nye County, Nevada, 11:11040 (R;US)
Whitlow, E., *See* Murphy, K., 11:11447
Whitney, R.R., *See* Minehart, R.C., 11:12293
Whitty, W.J., *See* Markin, J.T., 11:11092
Wick, E.A., How reliable does the waste package containment have to be, 11:11036 (RA;US)
Wickardt, U.J., Use of intensive mixing in the preparation of CWS, 11:10846 (RA;US)
Wiedersich, H., *See* Seshan, K., 11:11540
Wiencek, T.C., *See* Williams, R.K., 11:11280
Wignall, G.D., *See* Bates, F.S., 11:12135
Wikjord, A.G., *See* Gray, M.N., 11:11067
Wilcox, W., Lattice results on the meson electric form factor, 11:12254 (R;CA)
Wild, U.P., *See* Vo-Dinh, T., 11:11689
Wilde, B.E., *See* Rote, D.M., 11:10997
Wilde, E.W., Compliance of the Savannah River Plant P-Reactor cooling system with environmental regulations. Demonstrations in accordance with Sections 316(a) and (b) of the Federal Water Pollution Control Act of 1972, 11:11922 (R;US)
Wildman, D., *See* Ekmann, J., 11:10912
Wilets, L., Soliton Bag Model, 11:12225 (R;US)
See Schuh, A., 11:12361
Wilk, R.D., *See* Cernansky, N.P., 11:11728
Wilkens, A.B., *See* Hoffman, F.O., 11:11904
Wilkerson, J.F., Determination of the neutron lifetime using e-p coincidence, 11:12162 (R;US)
Wilkinson, F.J. III, *See* Cecil, F.E., 11:12291
Williams, D.W., *See* Vigil, S.A., 11:11126
Williams, F., *See* Qin, X.Z., 11:11715
Williams, F.A., *See* Dryer, F.L., 11:11730
Williams, J.M., *See* Beno, M.A., 11:11601
Williams, M.D., *See* Grisham, L.R., 11:12511
Williams, R.G., Emergence of interest groups on hazardous waste siting: how do they form and survive, 11:11389 (R;US)
Williams, R.K., Thermal conductivities of U_3Si and U_3Si_2-Al dispersion fuels, 11:11280 (R;US)
Williams, T.A., Economic evaluations of solar thermal energy systems using a levelized energy cost approach, 11:11177 (R;US)
Williams, W.R., Calculational methods for analysis of postulated UF_6 releases. Volume 2, 11:11078 (R;US)
Williamson, D.L., *See* Brown, J.D., 11:11704
Williford, R.E., *See* Apted, M.J., 11:11066
Willis, R.D., *See* Hurst, G.S., 11:12172
Willson, W.G., LRC liquefaction reducing gas composition and moisture effects product yield, quality and operability, 11:10740 (RA;US)
See Hauserman, W.B., 11:10827
Wilmore, D., Neutron scattering and reactions on 59Co from 1 to 20 MeV, 11:12323 (R;GB)
Wilson, B.W., *See* Gray, R.H., 11:10793
See Later, D.W., 11:11632
See Wright, C.W., 11:10927, 11:10928
Wilson, D.G., *See* Solomon, A.D., 11:11765
Wilson, J.H., *See* Mrochek, J.E., 11:10791
Wilson, J.R., *See* Symbalisty, E.M.D., 11:12048
Wilson, K.B., *See* Eustis, R.H., 11:11483
Wilson, K.G., *See* Gupta, R., 11:12252
Wilson, K.L., *See* Bastasz, R., 11:12471
Wilson, W.B., SOURCES calculation of TMI-2 spontaneous-fission and (α,n) neutron sources, 11:11254 (RA;US)

See LaBauve, R.J., 11:11269
Windom, H.L., Trace element geochemistry of the South Atlantic Bight. Progress report, 11:11907 (R;US)
See Blanton, J.O., 11:11913
Wing, B.J., *See* Kydes, A.S., 11:10960
Winje, R.A., *See* Grisham, L.R., 11:12511
Winkler, K.H.A., *See* Norman, M.L., 11:12042
Winokur, P.S., *See* McWhorter, P.J., 11:11778
Winschel, R.A., Coal liquefaction process solvent characterization and evaluation. Topical progress report, July 1, 1985-September 30, 1985, 11:10783 (R;US)
Winston, R., *See* O'Gallagher, J., 11:11198
Winter, E.R.F., *See* Steimle, F., 11:11382
Winter, F., Vehicle refrigeration, 11:11496 (RA;DE;In German)
Winters, P.J., Effect of fuel formulation on the atomization characteristics of coal-water mixtures, 11:10867 (RA;US)
Winters, W.S., TOPAZ - the transient one-dimensional pipe flow analyzer: equations and numerics, 11:12132 (R;US)
Wirsching, J.E., Multiprocessor model with distributed task creation, 11:12524 (R;US)
Wise, B.M., *See* Westsik, J.H. Jr., 11:11028
Wise, H., *See* Wood, B.J., 11:10741
Witherell, M.S., *See* Goulding, F.S., 11:12325
Witherspoon, J.P., *See* Jones, T.D., 11:10922
Withrow, S.P., *See* Edmond, J.A., 11:11555
Witschi, H.R., *See* Griest, W.H., 11:10919
Witte, P., *See* Knoblauch, K., 11:10743
Wobber, F.J., *See* Bollag, J.M., 11:11894
Wohlstetter, A., Evaluation of alternative nuclear employment policy/ technology. Executive summary - strategy, technology, and the threat. Technical report, 1 February-31 December 1982, 11:11853 (R;US)
Wohn, F.K., *See* Hill, J.C., 11:12283
See Wolf, A., 11:12327
Wolf, A., Magnetic moments of excited states in nuclei far from stability, 11:12327 (R;US)
See Hill, J.C., 11:12283
Wolf, E.E., FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report, 11:11130 (R;US)
Wolf, J.J., *See* Kopstein, F.F., 11:11328
Wolf, R.B., *See* Strojan, C.L., 11:11921
Wolfer, W.G., Effects of radiation and high heat flux on the performance of first-wall components. Final report, 11:12491 (R;US)
Wolfsberg, M., *See* Maessen, B., 11:11681
Wolk, I., *See* Costa, J.L.C., 11:12038
Woloshyn, R.M., *See* Wilcox, W., 11:12254
Woltersdorf, W., Influence of the cooling process on the sensory characteristics of fresh meat, 11:11468 (RA;DE;In German)
Wolynec, E., Photoneutron cross sections, 11:12334 (R;BR)
See Dias, H., 11:12343
Wong, K.L., Acceleration of beam ions during major-radius compression in the tokamak fusion test reactor, 11:12464 (J;US)
Wong, K.V., *See* Yeh, G.T., 11:11058
Woo, C.H., *See* Bahurmuz, A.A., 11:12063
Wood, B.J., Sodium chloride as a catalyst for the gasification of coal char. Final report, Tasks 8 and 9, 11:10741 (R;US)
Wood, C.W., Analysis of the effects of transient heat transfer on axial-flow-compressor-blade boundary layers. Master's thesis, 11:11762 (R;US)
Wood, R.F., *See* Geist, G.A., 11:11584
See Jellison, G.E. Jr., 11:11576
Wood, S., *See* Oliver, F.W., 11:11411
Woods, C.J., *See* Miller, P.D., 11:12118
Woods, C.L., *See* Drumm, P.V., 11:12311
See Fifield, L.K., 11:12310
Woods, K.N., *See* Ewing, R.H., 11:11232
Woolfolk, S., Radiological consequences of brine release by human intrusion into WIPP, 11:11923 (R;US)
Workhoven, R.M., Motion sensor evaluation using simulation, 11:11103 (J;US)
Worley, B.A., Thermal reactor design for a neutron scattering source facility, 11:11287 (R;US)
Wozniak, G.J., *See* Morrissey, D.J., 11:12346
Wright, B.W., Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
See Smith, R.D., 11:11620, 11:11631
Wright, C.W., Comparative biology and chemistry of boiling point fractions from different coal liquefaction processes, 11:10927 (R;US)
Methodologies for the separation of chemical classes from coal liquefaction materials, 11:10928 (R;US)
Wright, D., *See* Dooher, J.P., 11:10796
Wright, H.A., Physical and chemical events that follow the passage of a charged particle in liquid water, 11:12389 (R;US)
Wright, K.E., *See* Grisham, L.R., 11:12511
Wright, L.L., Short Rotation Woody Crops Program. Quarterly progress report, June 1-August 31, 1985, 11:11163 (R;US)
Wu, C.Q., *See* Xie, M., 11:10889
Wu, S.S.C., Topographic maps of Yucca Mountain area, Nye County, Nevada, 11:12031 (R;US)
Wuensch, B.J., *See* Didisheim, J.J., 11:11573
Wyckoff, H.L., *See* Stauffer, T.R., 11:11265
Wylie, W.R., *See* Schelin, H.R., 11:12298

X

Xiao, G.Y., *See* Wang, Y.S., 11:10882
Xie, M., Experimental study on coal-water slurry combustion on a 20t/h oil-fired boiler, 11:10889 (RA;US)
Xinyu, C., *See* Kefa, C., 11:10873
See Mingjiang, N., 11:10871
Xu, R., *See* Liao, C.L., 11:12099

Y

Yaakobi, B., *See* Delettrez, J., 11:12485
See Jaanimagi, P.A., 11:12490
Yamada, M., *See* Jardin, S.C., 11:12499
Yamada, R., Measurement of the magnetic field of the CDF magnet, 11:11821 (R;US)
Yamada, T., *See* Nagata, K.I., 11:10847
Yamakawa, O., *See* Tanihata, I., 11:12307
Yamamoto, R., Auxin-induced modifications of cell wall polysaccharides in cat coleoptile segments. Effect of galactose, 11:11932 (RA;US)
Yang, C.S., *See* Hadlock, D.E., 11:11836
Yang, J.W., Analysis of hydrogen production during a BWR6 core heatup transient, 11:11296 (R;US)
Yano, T., *See* Nagata, K.I., 11:10847
Yao, Y., *See* Frere, J., 11:12263
Yao, Y.Q., *See* Gao, J., 11:10869
Yap, R.F., *See* Sepulveda, J.L., 11:10844
Yasumura, S., *See* Glaros, D., 11:11980
Yates, J.T. Jr., *See* Ceyer, S.T., 11:11680
Yates, K., *See* Sullivan, J.P., 11:11819
Yavin, A.I., *See* Dombsky, M., 11:12344
Yazvitskij, Yu.S., *See* Popov, Yu.P., 11:12335
Yeh, G.T., Development and applications of two finite element groundwater flow and contaminant transport models: FEWA and FEMA, 11:11058 (R;US)
Yen, T.F., Microbial screening test for lignite degradation. Quarterly progress report No. 4, October-December 1985, 11:10799 (R;US)
Yerkes, C.T., *See* Itoh, S., 11:11174
Yin, G.A., *See* Shan, Z.Y., 11:12394
Yip, B.C.Y., Trace detection in gases using photoacoustic spectroscopy and Fabry-Perot interferometry, 11:11637 (D;US)
Yiu, S.M., *See* Hedley, A.B., 11:10864
Yntema, J.L., *See* Kutschera, W., 11:11726
Yoder, J.A., *See* Blanton, J.O., 11:11913
Yodh, G.B., Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)
Yonker, C.R., *See* Smith, R.D., 11:11620
York, W.S., KDO (3-deoxy-manno-octulosonic acid), a glycosyl residue thought to occur only in enterobacterial polysaccharides, is also a component of the cell wall of higher plants, 11:11945 (RA;US)
See Albersheim, P., 11:11951
Yoshikawa, N., *See* Tanihata, I., 11:12307
Young, J.P., *See* Rosseel, T.M., 11:12115
Youngblood, D.H., Statistics of cyclotron operation, 11:11786 (RA;US)
See Sullivan, J.P., 11:11819
Youngblood, R.W., *See* Cho, N.Z., 11:11294
Yu, K.M., Applications of heavy-ion Rutherford backscattering spectrometry (HIRBS) to the analysis of contact structures on GaAs and Ge, 11:11543 (J;NL)
Yu, W.S., *See* Ludewig, H., 11:11297
Yuanquan, C., *See* Mingjiang, N., 11:10871

Z

Zabel, V., *See* Saenger, W., 11:11946
Zabransky, B.J., *See* Kanter, E.P., 11:12117
Zajicek, W., *See* Haisler, R., 11:11798
Zappe, D., Safety assessment of underground nuclear waste repositories using the method of status vectors, 11:11035 (R;DD;In German)
Zaquine, I., Characterization of SIS functions in a heterodyne receiver at 33GHz, 11:11822 (R;FR;In French)
Zarand, P., Relative standard deviation of thermoluminescence dosimetry - comparison of the experiments with theory, 11:11826 (RA;AT)
Zeikus, J.G., One carbon metabolism in anaerobic bacteria: organic acid and methane production. Final technical report, 11:11129 (R;US)
Zel'dovich, A.G., *See* Bartenev, V.D., 11:11745
Zelinski, A., *See* Novgorodov, A.F., 11:11720
Zemb, T. Charpin, P., X-neutron comparative study of direct ionic micelles, 11:12381 (R;FR)
Zhang, C.M., *See* Wang, Y.S., 11:10882
Zhang, H.X., High resolution studies of photofission of ^{232}Th and ^{238}U, 11:12349 (R;US)
Zhang, R., *See* Wang, Z., 11:10833
Zhang, X.Q., *See* Wang, Y.S., 11:10882
Zhang, Z., *See* Wang, Z., 11:10833
Zhenyu, H., *See* Mingjiang, N., 11:10871
Ziegler, W., Polarized proton induced pion production on ^{10}B at 200, 225, 250 and 260 MeV incident energies, 11:12305 (R;CA)
Ziehlke, K.T., *See* Barlow, C.R., 11:11746
Zielinska, S., Collision kernels in the eikonal approximation for Lennard-Jones interaction potential, 11:12084 (R;IT)
Ziff, R., *See* Savit, R., 11:12417
Zijp, W.L., *See* Piksaikin, V., 11:11924
Zimerman, A.H., *See* Aratyn, H., 11:12232, 11:12233
Zimmermann, M., Handbook on the utilisation of solar energy in buildings, 11:11187 (RA;CH;In German)
Zinker, S., *See* Diaz, S., 11:11939
Zivadinovic, M., *See* Dvornik, I., 11:11827
Zorn, G.T., *See* Chang, C.Y., 11:11807, 11:12147
See Glasser, R.G., 11:12146
Zorro, R., *See* Andersson, P., 11:12331
Zronek, S.C., Size and composition of particulate emissions from the combustion of coal slurries, 11:10807 (RA;US)
Zuhr, R.A., Accelerator-based plasma-wall interaction studies on the TEXTOR tokamak, 11:12470 (J;NL)
Zwicki, R.D., *See* Tsurutani, B.T., 11:12058

SUBJECT INDEX

The subject index is based on the use of subject descriptors selected from a controlled thesaurus of terms (DOE/TIC-7000). Subject descriptors and qualifiers (subheadings) are selected and presented in the following format:

SUBJECT DESCRIPTOR
Qualifier
Title, (supplementary information), citation number, (R;US)

The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept (e.g., Pipeline Quality Gas, see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161.

A

AAEC
Indexes
AAEC report titles - cumulation 1976-1984, 11:12516 (R;AU)

ABANDONED SHAFTS
Fires
Excavation evaluation of the controlled burnout of an abandoned coal mine, 11:10776 (RA;US)
Waste Heat Utilization
Excavation evaluation of the controlled burnout of an abandoned coal mine, 11:10776 (RA;US)

ABLATION
For the medical concept use SURGERY or RADIOTHERAPY.
Computerized Simulation
LLE Review. Quarterly report, April-June 1985, 11:12488 (R;US)
Time Dependence
LLE Review. Quarterly report, April-June 1985, 11:12488 (R;US)

ABNORMALITIES (CHROMOSOMAL)
See CHROMOSOMAL ABERRATIONS

ABSORBED DOSES
See RADIATION DOSES

ACCELERATORS
See also LINEAR ACCELERATORS
Design
Beam breakup and the conceptual design of guided and unguided accelerators, 11:11791 (R;US)

ACCESS DENIAL SYSTEMS
See ENTRY CONTROL SYSTEMS

ACCIDENTAL IRRADIATION
See RADIATION ACCIDENTS

ACES
See QUARKS

ACETALDEHYDE
Chemical Reaction Yield
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)

ACETIC ACID
Chemical Reaction Yield
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)

ACETIC ACID ESTERS
Chemical Reaction Yield
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)

ACETIC ALDEHYDE
See ACETALDEHYDE

ACETOPHENONE
Supercritical Fluid Chromatography
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)

ACETYLBENZENE
See ACETOPHENONE

ACETYLENE
Adsorption
Observation of isolated carbon atoms and the study of their mobility on Pt clusters by NMR, 11:11534 (J;US)
Photoacoustic Spectroscopy
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)

ACID MINE DRAINAGE
Land Pollution Abatement
Control of acid mine drainage. Proceedings of a technology-transfer seminar. Information circular/1985, 11:10811 (R;US)
Water Pollution Abatement
Control of acid mine drainage. Proceedings of a technology-transfer seminar. Information circular/1985, 11:10811 (R;US)

ACID RAIN
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Biological Effects
Acidic deposition: effects on agricultural crops. Final report, April 1980-31 December 1984, 11:12009 (R;US)
Land Pollution
Effects of acid precipitation on a typical quartzipsamment soil in Florida, 11:11896 (R;US)
Natural Occurrence
Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)
Pollution Sources
Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)

Regional Analysis
Comparison of a multilayer regional-scale acid rain assessment model (MLRAPT) with a single-layer assessment model, RAPT, 11:11872 (R;US)
Water Pollution
Effects of acid precipitation on a typical quartzipsamment soil in Florida, 11:11896 (R;US)
ACOUSTIC EMISSION TESTING
On-line acoustic emission monitoring of nuclear reactor systems: status and future, 11:11270 (R;US)
ACRIDONES
Photochemistry
Photophysical behaviors of N-methylthioacridone triplet and efficiency of singlet oxygen generation from its quenching by oxygen, 11:11707 (J;NL)
ACROLEIC ACID
See ACRYLIC ACID
ACRYLIC ACID
Raman Spectroscopy
Multiresonant four-wave mixing spectroscopy of pentacene in naphthalene, 11:11688 (J;US)
ACTINIDES
See also AMERICIUM
CURIUM
NEPTUNIUM
PLUTONIUM
THORIUM
URANIUM
Extraction Chromatography
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinides elements, 11:11607 (R;FR)
Materials Recovery
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinides elements, 11:11607 (R;FR)
Solvent Extraction
Actinide-lanthanide group separation using sulfur and nitrogen donor extractants, 11:11606 (R;FR)
ACTIVATED CARBON
Performance Testing
Anaerobic treatment of gasifier effluents. Final report, 11:10803 (R;US)
Surface Cleaning
Elution of benzene and methyl ethyl ketone from charcoal beds by continued air sweeping. Interim report, March 1983-November 1984, 11:11782 (R;US)
ACTIVATION ANALYSIS
Background Noise
Activation measurements of neutron-capture cross sections in the MeV region, 11:11616 (R;SE)
Meetings
Proceedings of the third meeting on nuclear analysis, 11:11623 (R;DD;In English, German and Russian)
ADDITIVES
Field Tests
Field test of drag reducing agents in a three-inch pipeline at the West Hackberry, Louisiana SPR site (A guar and 6 polyacrylamide drag reducing agents), 11:10957 (R;US)
ADDUCTS
See also DNA ADDUCTS
Dipole Moments
Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet, 11:12096 (J;US)
Infrared Spectra
Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet, 11:12096 (J;US)
Molecular Structure
Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet, 11:12096 (J;US)
Photoionization
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
AEROSOLS
See also RADIOACTIVE AEROSOLS
Chemical Composition
Sampling, characterization, and remote sensing of aerosols formed in the atmospheric hydrolysis of uranium hexafluoride, 11:11070 (J;US)
Deposition
Fall-out, wash-out, and rain-out from airborne clouds, 11:11877 (BA;US)
Flammability
Effects of reactor core-simulant aerosols on hydrogen/air combustion, 11:11349 (R;US)
Particle Size
Aerosol formation from pulverized coal combustion. Quarterly report No. 8, 11:10907 (R;US)
Remote Sensing
Sampling, characterization, and remote sensing of aerosols formed in the atmospheric hydrolysis of uranium hexafluoride, 11:11070 (J;US)
Washout
Fall-out, wash-out, and rain-out from airborne clouds, 11:11877 (BA;US)
AFTER-HEAT REMOVAL
Heat Transfer
EBR-II Shutdown Heat Removal Testing Program results and plans, 11:11299 (R;US)
Modeling of reflux condensation and countercurrent annular flow in a two-phase closed thermosyphon, 11:11312 (R;US)
Hydraulics
EBR-II Shutdown Heat Removal Testing Program results and plans, 11:11299 (R;US)
Modeling of reflux condensation and countercurrent annular flow in a two-phase closed thermosyphon, 11:11312 (R;US)
Testing
EBR-II Shutdown Heat Removal Testing Program results and plans, 11:11299 (R;US)
Two-Phase Flow
Modeling of reflux condensation and countercurrent annular flow in a two-phase closed thermosyphon, 11:11312 (R;US)
AGRICULTURAL RESIDUES
See AGRICULTURAL WASTES
AGRICULTURAL WASTES
See also BAGASSE
MANURES
Anaerobic Digestion
Use of appropriate technologies for biomass waste conversion in small communities, 11:11126 (RA;PR)
Combustion
Planning waste-to-energy plants in Puerto Rico, 11:11146 (RA;PR)
Energy Source Development
Opportunities for biomass energy projects in the State of California, 11:11124 (RA;PR)
Gasification
Using agricultural waste in gas generators and its importance for developing countries, 11:11211 (RA;DE;In German)
AGRICULTURE
Energy Conservation
Agricultural technology, 11:11463 (R;DE;In German and English)
Fuel Substitution
Biomass fuel use in agriculture under alternative fuel prices, 11:11133 (J;US)
AIR
Ionization
Ionization rate measurements, 11:11852 (R;US)
Radiation Monitoring
Environmental Radiation Data report 30, April-June 1982. Quarterly report, 11:11885 (R;US)
Environmental Radiation Data report 29: January-March 1982, 11:11883 (R;US)
Environmental Radiation Data report 28: October-December 1981, 11:11884 (R;US)

AIR CLEANING SYSTEMS
Activated Carbon
Elution of benzene and methyl ethyl ketone from charcoal beds by continued air sweeping. Interim report, March 1983-November 1984, 11:11782 (R;US)
Charcoal
Elution of benzene and methyl ethyl ketone from charcoal beds by continued air sweeping. Interim report, March 1983-November 1984, 11:11782 (R;US)
AIR CONDITIONERS
See also SOLAR AIR CONDITIONERS
Design
Air-fed evaporators and condensing units, 11:11440 (RA;DE;In German)
Performance
Air-fed evaporators and condensing units, 11:11440 (RA;DE;In German)
AIR POLLUTION
See also INDOOR AIR POLLUTION
Biological Effects
Acidic deposition: effects on agricultural crops. Final report, April 1980-31 December 1984, 11:12009 (R;US)
Metabolic activation pathways of cyclopenta-fused PAH (polycyclic aromatic hydrocarbons) and their relationship to genetic and carcinogenic activity, 11:11870 (R;US)
Diffusion
Graphical solutions to atmospheric diffusion problems, 11:11878 (BA;US)
Outline of atmospheric diffusion theories, 11:11875 (BA;US)
Mathematical Models
Atlantic Coast Unique Regional Atmospheric Tracer Experiment (ACURATE), 11:11864 (R;US)
Meteorology
Air pollution aspects of the atomic energy industry, 11:11888 (BA;US)
Meteorology and atomic energy, 11:11887 (B;US)
Meteorology in site operations, 11:11889 (BA;US)
Meteorological fundamentals for air pollution studies, 11:11874 (BA;US)
Regional Analysis
Atlantic Coast Unique Regional Atmospheric Tracer Experiment (ACURATE), 11:11864 (R;US)
Stack Disposal
Behavior of stack effluents, 11:11876 (BA;US)
AIR SOURCE HEAT PUMPS
Optimization
Improvement of operational behaviour of a heating system equipped with a water/air source heat pump, 11:11435 (RA;DE;In German)
AIRBORNE PARTICLES
See PARTICULATES
AIRBORNE PARTICULATES
See PARTICULATES
AIRFOILS
Computerized Simulation
Computation of the transonic flow about a swept wing in the presence of an engine nacelle, 11:12127 (R;US)
ALAP
See RADIATION PROTECTION
ALARM DOSEMETERS
See RADIATION MONITORS
ALARM SYSTEMS
See also MOTION DETECTION SYSTEMS
Efficiency
Monitoring alarm resolution effectiveness, 11:11091 (J;US)
Errors
Monitoring alarm resolution effectiveness, 11:11091 (J;US)
Monitoring
Monitoring alarm resolution effectiveness, 11:11091 (J;US)
Systems Analysis
Resolving MC & A alarms from process monitoring in a fuel fabrication facility, 11:11090 (J;US)
ALASKA
Continental Shelf
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 4. Effects of contaminants, 11:10948 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 5. Transport, 11:10949 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1980. Volume 6. Transport, 11:10945 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1980. Volume 7. Transport data management, 11:10946 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 3. Effects of contaminants, 11:10947 (R;US)
Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 6. Transport, 11:10950 (R;US)
Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 7. Hazards, 11:10951 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 8. Hazards and data management, 11:10952 (R;US)
Environmental assesament of the Alaskan Continental Shelf. Final reports of principal investigators. Volume 18. Biological studies, 11:10953 (R;US)
Framework for oil-spill response on the Alaskan OCS (Outer Continental Shelf), 11:10940 (R;US)
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 28, 11:10943 (R;US)
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 29, 11:10944 (R;US)
ALBERTA
Coal Industry
Alberta's coal industry - annual statistics at 31 December 1984, 11:10917 (R;CA)
Coal Preparation Plants
Alberta's coal industry - annual statistics at 31 December 1984, 11:10917 (R;CA)
ALCATOR DEVICE
Cyclotron Radiation
Non-thermal electron velocity distribution measured by electron cyclotron emission in Alcator C tokamak, 11:12446 (R;US)
Drift Instability
Renormalized turbulence theory of ion pressure gradient driven drift modes, 11:12432 (R;US)
Energy Spectra
Non-thermal electron velocity distribution measured by electron cyclotron emission in Alcator C tokamak, 11:12446 (R;US)
Pellet Injection
m = 1, n = 1 oscillations following the injection of a fuel pellet on the Alcator C tokamak, 11:12492 (R;US)
X-Ray Spectra
m = 1, n = 1 oscillations following the injection of a fuel pellet on the Alcator C tokamak, 11:12492 (R;US)
ALCOHOL FUELS
Use for pure alcohols, alcohol-water mixtures, or alcohols with additives; for alcohol-gasoline mixtures, use GASOHOL.
See also ETHANOL FUELS
Exhaust Gases
Characterization of exhaust emissions from alcohol-fueled vehicles. Final report, 11:11498 (R;US)
ALCOHOLATES
See ALKOXIDES
ALCOHOLS
See also BUTANOLS
DECANOLS
ETHANOL
HEXANOLS
METHANOL
OCTANOLS
PROPANOLS

Production
Production of alcohol from Jerusalem artichoke for gasoline additive, 11:11143 (R;US)
Solubility
Removal of n-alcohols from an aqueous stream using micellar-enhanced ultrafiltration, 11:11672 (R;US)
Ultrafiltration
Removal of n-alcohols from an aqueous stream using micellar-enhanced ultrafiltration, 11:11672 (R;US)

ALDEHYDO ACIDS
See CARBOXYLIC ACIDS

ALFVEN WAVES
Symmetry Breaking
Spontaneous symmetry breaking and neutral stability in the noncanonical Hamiltonian formalism, 11:12434 (R;US)

ALGAE
See also NITELLA
Growth
Studies of marine macroalgae: saline desert water cultivation and effects of environmental stress on proximate composition. Final subcontract report (Gracilaria tikvahiae; Ulva lactuca), 11:11170 (R;US)

ALGEBRA
Multiplets
Multiplets of indecomposable highest weight modules over infinite-dimensional Lie algebras: The Virasoro - A_1 correspondence, 11:12228 (R;IT)

ALKALI METAL COMPLEXES
Electrochemistry
Ultra high vacuum electrochemistry with conducting polymers, 11:11701 (J;GB)

ALKALI METAL COMPOUNDS
See also LITHIUM COMPOUNDS
POTASSIUM COMPOUNDS
SODIUM COMPOUNDS
Removal
Hot gas cleanup for pressurized fluidized bed combustion burning low rank coal, 11:10903 (RA;US)
X-Ray Spectra
Ion-excited K X-ray spectra of oxygen, 11:12076 (RA;US)

ALKALI METALS
See also CESIUM
LITHIUM
POTASSIUM
RUBIDIUM
SODIUM
Electric Conductivity
Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem, 11:11518 (R;IT)
Energy-Level Density
Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem, 11:11518 (R;IT)

ALKALINE EARTH METAL COMPOUNDS
Dissociation Energy
Ion model and dipole polarizabilities in energy calculations, 11:11580 (R;IT)
Polarizability
Ion model and dipole polarizabilities in energy calculations, 11:11580 (R;IT)
Solvent Extraction
Competitive solvent extraction of alkaline-earth cations into chloroform by lipophilic acyclic diionizable polyethers, 11:11627 (J;US)
X-Ray Spectra
Ion-excited K X-ray spectra of oxygen, 11:12076 (RA;US)

ALKALINE EARTH METALS
See also BERYLLIUM
CALCIUM
MAGNESIUM
STRONTIUM
Electric Conductivity
Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem, 11:11518 (R;IT)
Energy-Level Density
Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem, 11:11518 (R;IT)

ALKANES
See also BUTANE
DECANE
DODECANE
ETHANE
HEXANE
METHANE
OCTANE
PENTANE
PROPANE
Chemical Preparation
Preparation of $Yb[N(SiMe_3)_2]_2[AiMe_3]_2$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
Crystal Structure
Preparation of $Yb[N(SiMe_3)_2]_2[AiMe_3]_2$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
Photoelectron Spectroscopy
Transition metal-isocyanide bonding: Photoelectron spectroscopic study of iron tetracarbonyl isocyanide complexes, 11:11659 (J;US)

ALKANOIC ACIDS
See CARBOXYLIC ACIDS

ALKENOIC ACIDS
See CARBOXYLIC ACIDS

ALKOXIDES
Catalytic Effects
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985 (Potassium methoxide), 11:11142 (R;US)

ALKYLATES
See ALCOHOLS

ALLOY 800H
See INCOLOY 800H

ALLOY-MA-956
See IRON BASE ALLOYS

ALLOYS
See also ALUMINIUM ALLOYS
BERYLLIUM ALLOYS
CHROMIUM ALLOYS
COPPER ALLOYS
GOLD ALLOYS
HEAT RESISTING ALLOYS
IRON ALLOYS
LEAD ALLOYS
LITHIUM ALLOYS
MANGANESE ALLOYS
NICKEL ALLOYS
NIOBIUM ALLOYS
PHOSPHORUS ADDITIONS
REFRACTORY METALS
SILICON ALLOYS
TIN ALLOYS
TITANIUM ALLOYS
YTTRIUM ALLOYS
ZIRCONIUM ALLOYS
Crack Propagation
Overload effect and fatigue crack propagation in amorphous metallic alloys, 11:11548 (J;US)
Fatigue
Overload effect and fatigue crack propagation in amorphous metallic alloys, 11:11548 (J;US)
Stress Analysis
Overload effect and fatigue crack propagation in amorphous metallic alloys, 11:11548 (J;US)

ALPHA DETECTION
Si Semiconductor Detectors
Measurement of the total specific alpha activity with silicon detector, 11:11828 (RA;AT)

ALPHA PARTICLE MODEL
See CLUSTER MODEL

ALPHA PARTICLES
Emitted by nuclei.
Slowing-Down
Effects of an alpha particle slowing-down distribution on tokamak ballooning modes, 11:12443 (R;US)

ALPHA REACTIONS
Giant Resonance
Statistical decay of giant monopole resonance in ^{208}Pb, 11:12343 (R;BR)
Neutron Spectra
Statistical decay of giant monopole resonance in ^{208}Pb, 11:12343 (R;BR)

Nuclear Fragments
Emission of light fragments ^{3}H, ^{3}He and ^{4}He in ^{4}He-nucleus collisions at 3.33 GeV/N kinetic energy, 11:12369 (R;SU)
Nuclear Reaction Yield
Emission of light fragments ^{3}H, ^{3}He and ^{4}He in ^{4}He-nucleus collisions at 3.33 GeV/N kinetic energy, 11:12369 (R;SU)
Particle Production
π^+ and π^- production in the α-nucleus and nucleus-nucleus collisions between 200 and 800 MeV/nucleon, 11:12342 (R;FR;In French)
Search for quark deconfinement: Strangeness production in pp, dd, pα, and $\alpha\alpha$ collisions at $\sqrt{s}$/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)

ALPHA-BEARING WASTES
Forecasting
Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1, 11:11005 (R;US)
Gamma Spectroscopy
Measurement methods of alpha activity in nuclear wastes: gamma spectrometry, detection of fission neutrons, 11:11080 (R;FR;In French)
Inventories
Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1, 11:11005 (R;US)
Leaching
Effects of α-radiolysis on leaching of a nuclear waste glass, 11:11046 (J;US)
Neutron Detection
Measurement methods of alpha activity in nuclear wastes: gamma spectrometry, detection of fission neutrons, 11:11080 (R;FR;In French)
Radioactive Waste Disposal
Annual technology assessment and progress report for the Buried Transuranic Waste Program at the Idaho National Engineering Laboratory, 11:11012 (R;US)
Long-range plan for buried transuranic waste studies at the Idaho National Engineering Laboratory, 11:11011 (R;US)
The radioactive waste disposal problem has a solution - the Waste Isolation Pilot Plant project, 11:11051 (J;US)
Radioactive Waste Management
Management of TRU waste at the Idaho National Engineering Laboratory, 11:11049 (J;US)
Radioactive Waste Storage
Management of TRU waste at the Idaho National Engineering Laboratory, 11:11049 (J;US)
Radiolysis
Effects of α-radiolysis on leaching of a nuclear waste glass, 11:11046 (J;US)
Vitrification
Effects of α-radiolysis on leaching of a nuclear waste glass, 11:11046 (J;US)

ALTERNATE FUELS
See FUEL SUBSTITUTION
SYNTHETIC FUELS

ALUMINATES
Specific compounds, except those of significance to energy research and development, should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.
Physical Radiation Effects
Irradiation of lithium aluminate and tritium extraction, 11:12474 (R;FR)

ALUMINIA
See ALUMINIUM OXIDES

ALUMINIUM
Deformation
Summary of recent research on mechanical behavior of polycrystalline solids. Progress report, March 1985-March 1986, 11:11512 (R;US)
Electron Diffraction
Truncation-induced relaxations of a high-index surface: Al(311), 11:12123 (J;NL)
Melting
[Experiments on the OMEGA Laser System]. LLE Review. Quarterly report, July-September 1985. Volume 24, 11:12489 (R;US)
Proton Reactions
Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)
Strain Rate
Summary of recent research on mechanical behavior of polycrystalline solids. Progress report, March 1985-March 1986, 11:11512 (R;US)
Stress Relaxation
Summary of recent research on mechanical behavior of polycrystalline solids. Progress report, March 1985-March 1986, 11:11512 (R;US)

ALUMINIUM 27 TARGET
Alpha Reactions
Emission of light fragments ^{3}H, ^{3}He and ^{4}He in ^{4}He-nucleus collisions at 3.33 GeV/N kinetic energy, 11:12369 (R;SU)
Antiproton Reactions
Description of antiproton-nucleus scattering with the proton-nucleus Dirac impulse approximation optical potential, 11:12300 (R;BR)
Beryllium 9 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Carbon 12 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
Heavy Ion Fusion Reactions
Fission-like phenomena for systems with mass A=110, 11:12312 (R;FR)
Lithium 6 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Lithium 7 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Lithium 8 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Neon 20 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)

ALUMINIUM ALLOYS
See also ALUMINIUM BASE ALLOYS
Ionic Conductivity
Transport mechanisms in β-lithium/aluminum: an overview, 11:11367 (R;US)
Mass Transfer
Transport mechanisms in β-lithium/aluminum: an overview, 11:11367 (R;US)
Thermal Conductivity
Thermal conductivities of U_3Si and U_3Si_2-Al dispersion fuels, 11:11280 (R;US)

ALUMINIUM ARSENIDES
Crystallography
Applications of heavy-ion Rutherford backscattering spectrometry (HIRBS) to the analysis of contact structures on GaAs and Ge, 11:11543 (J;NL)

ALUMINIUM BASE ALLOYS
Plasticity
Superplastic properties of an Al-Cu-Li-Zr alloy, 11:11542 (J;GB)
Production
Formation of surface layers of icosahedral Al(Mn), 11:11528 (R;US)

ALUMINIUM COMPOUNDS
See also ALUMINATES
ALUMINIUM ARSENIDES
ALUMINIUM OXIDES
Chemical Preparation
Preparation of $Yb[N(SiMe_3)_2]_2[AiMe_3]_2$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
Crystal Structure
Preparation of $Yb[N(SiMe_3)_2]_2[AiMe_3]_2$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)

Leaching
Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)
Mass Spectroscopy
Mass spectrometry of inductively coupled plasmas, 11:11624 (J;US)
Natural Occurrence
Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)
Pollution Sources
Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)

ALUMINIUM IONS
Electron-Ion Collisions
Electron collisions with positive ions. Progress report, April 1, 1985-March 31, 1986, 11:12079 (R;US)

ALUMINIUM OXIDES
Catalytic Effects
Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985, 11:10785 (R;US)
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)
Ion Implantation
Formation of amorphous layers in Al_2O_3 by ion implantation, 11:11563 (J;NL)
Hardness of ion implanted ceramics, 11:11556 (R;US)
Physical Radiation Effects
Study of the thermal annealing of γ-irradiation effects in Al_2O_3: Mn, 11:11554 (R;FR)
Sorptive Properties
Standardization of alumina and silica adsorbents used for chemical class separations of polycyclic aromatic compounds, 11:11632 (J;US)

ALUMINIUM-AIR BATTERIES
Performance Testing
Aluminum-Air Power Cell: the M4-cell assembly and initial tests, 11:11373 (R;US)

ALUMINUM
See ALUMINIUM

ALVEOLI (PULMONARY)
See LUNGS

AMBIENT TEMPERATURE
Environmental Impacts
Associations between summer circulation anomalies and sea surface temperature forcing, 11:11863 (R;US)

AMERICAN INDIANS
Energy Source Development
Program and financial report on Department of Energy, 11:11385 (R;US)
Resource Development
Program and financial report on Department of Energy, 11:11385 (R;US)

AMERICIUM
Extraction Chromatography
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinide elements, 11:11613 (RA;XA)
Radionuclide Migration
Laboratory simulation of radionuclide geological migration, 11:11068 (RA;US)
Solvent Extraction
Process for the recovery of americium from analytical wastes, 11:11605 (R;FR)

AMERICIUM 241
Diffusion
Investigation of siting parameters for near surface disposal of low-level nuclear waste. Final report, 11:11000 (R;US)
Dosimetry
Factors affecting the assessment of lung depositions of transuranics, 11:12000 (R;US)

AMINES
See also ANILINE
HYDROXYLAMINE
MUCOPOLYSACCHARIDES
POLYCYCLIC AROMATIC AMINES
RHODAMINES
Comparative Evaluations
Enhanced coal liquefaction with ammonia and amines in single and binary solvent systems. Seventh quarterly report, April 1-June 30, 1985, 11:10780 (R;US)
Mutagen Screening
Exploratory research on mutagenic activity of coal-related materials using statistical evaluation (2-aminoanthracene), 11:10921 (R;US)

AMINO ALCOHOLS
See ALCOHOLS
AMINES

AMINO SUGARS
See AMINES

AMINOBENZENE
See ANILINE

AMINOGLYCIDES
See AMINES

AMMONIA
Reduction
Studies of metal ammonia interactions with aromatic substrates. Final report, December 18, 1979-February 28, 1985, 11:11671 (R;US)

AMMONIUM HALIDES
Interference
Suppression of analyte signal by various concomitant salts in inductively coupled plasma mass spectrometry, 11:11625 (J;US)

AMPLIFIERS
See also LOCK-IN AMPLIFIERS
MICROWAVE AMPLIFIERS
SQUID Devices
dc SQUIDs as radiofrequency amplifiers, 11:11752 (J;US)

AMYLUM
See STARCH

ANALOG-TO-DIGITAL CONVERTERS
Design
Fast-response analog-to-digital processor for event selection by the difference in numbers of particles, 11:11835 (R;SU;In Russian)

ANALYSIS (ACTIVATION)
See ACTIVATION ANALYSIS

ANALYSIS (GAS)
See GAS ANALYSIS

ANESTHETICS
Biological Effects
Problems associated with dimensional analysis of electroencephalogram data, 11:11978 (R;US)

ANHYDRITE
Heat Transfer
Effective heat transfer in the Strategic Petroleum Reserve porous media, 11:10956 (R;US)

ANILINE
Supercritical Fluid Chromatography
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)

ANIMAL FEEDS
Materials Recovery
Grain sorghum stillage processing: nutrient recovery and pollution control, 11:11134 (RA;PR)

ANIONS
Crystal Structure
Structure of 3,4;3′,4′-bis(ethylenedithio)-2,2′,5,5′-tetrathiafulvalent-tetrabromoindate (2:1), (BEDT-TTF)$_3$InBr$_4$, ($C_{10}H_8S_8$)$_3$InBr$_4$, 11:11601 (J;DK)

ANISOLE
Labelling
Mechanism of tritium-atom promoted isotope exchange in the benzene ring. 2. Substituent effects and a crossover in labelling mechanism, 11:11693 (J;US)

ANNIHILATION
Quantum Chromodynamics
Direct photon production from pions and protons at 200 GeV/c, 11:12295 (R;CH)

ANNUAL CYCLE ENERGY SYSTEM
Vapor-compression heat pump system field tests at the TECH complex, 11:11456 (J;US)
ANTHRACENE
Oxidation
Oxidation of arenes by molten gallium(III) chloride, 11:11696 (J;GB)
ANTILAMBDA PARTICLES
Photoproduction
Study of inclusive K/sub S/^{0}, Λ, and Lambda-bar production in diffractive γp interactions, 11:12165 (J;US)
ANTIMICROBIAL AGENTS
Biochemistry
Identification of oligogalacturonide-elicitors of phytoalexin accumulation released from sodium polypectate by an endopolygalacturonic acid lyase, 11:11937 (RA;US)
ANTIMUONS
See MUONS PLUS
ANTIPROTON REACTIONS
Annihilation
Antiproton-nucleon physics at LEAR, 11:12284 (R;FR;In French)
Backscattering
Back-angle scattering of antiprotons from nuclei, 11:12301 (R;BR)
Elastic Scattering
Back-angle scattering of antiprotons from nuclei, 11:12301 (R;BR)
Near/far decomposition of the proton-nucleus and antiproton-nucleus elastic scattering angular distributions, 11:12320 (R;BR)
Impulse Approximation
Description of antiproton-nucleus scattering with the proton-nucleus Dirac impulse approximation optical potential, 11:12300 (R;BR)
Scattering
Antiproton-nucleon physics at LEAR, 11:12284 (R;FR;In French)
Description of antiproton-nucleus scattering with the proton-nucleus Dirac impulse approximation optical potential, 11:12300 (R;BR)
ANTIPROTONIC ATOMS
See HADRONIC ATOMS
ANTIPROTONS
Cosmic Ray Sources
Galactic antiprotons from photinos, 11:12047 (J;US)
APPLIANCES
Energy Efficiency
Economics of efficiency improvements in residential appliances and space conditioning equipment, 11:11455 (J;US)
Energy sources: conservation and renewables, 11:11450 (B;US)
APPLICATORS (RADIOTHERAPY)
See RADIATION SOURCES
AQUATIC ECOSYSTEMS
See also WETLANDS
Environmental Impacts
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 28, 11:10943 (R;US)
Toxic effects on individuals, populations, and aquatic ecosystems and indicators of exposure to chemicals, 11:11916 (R;US)
AQUATIC ORGANISMS
Unspecified biota characteristic of aquatic ecosystems.
See also BENTHOS
FISHES
PLANKTON
Environmental Impacts
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 29, 11:10944 (R;US)
AQUEOUS SOLUTIONS
Refractivity
Interferometric measurement techniques in double-diffusive systems. Technical progress report, 11:11643 (R;US)
AQUIFERS
Radionuclide Migration
Development and applications of two finite element groundwater flow and contaminant transport models: FEWA and FEMA, 11:11058 (R;US)
Water Pollution
Techniques used in the determination of the areal extent of organic contamination at the US DOE Hoe Creek underground gasification site, 11:10808 (RA;US)
Water Pollution Control
Batch and column extraction procedures for organics in solid wastes, 11:11480 (J;US)
ARC WELDING
Equipment
Process and equipment capabilities, Materials Joining Laboratory, 1985, 11:11747 (R;US)
ARGON
Adducts
Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet, 11:12096 (J;US)
Complexes
Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet, 11:12096 (J;US)
Infrared Spectra
Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet, 11:12096 (J;US)
Ion-Atom Collisions
Coincidence techniques to study electron emission in ion-atom collisions, 11:12108 (J;NL)
Investigations of molecular orbitals with accel-decel beams, 11:12104 (J;NL)
Production of projectile and target K X-rays by single and multiple electron capture in collisions of Si^{14+} and Si^{13+} ions with argon atoms at 4.5 and 5.5 MeV/amu, 11:12064 (R;FR)
ARGON 40 REACTIONS
Compound-Nucleus Reactions
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
Fission
Sequential fission angular distributions from mass-asymmetric heavy-ion reactions, 11:12346 (J;NL)
Linear Momentum Transfer
Linear momentum transfer in the $^{40}Ar + {}^{238}U$ system for projectile energies from 20 to 44 MeV/u, 11:12348 (R;FR)
ARGON IONS
Auger Electron Spectroscopy
Auger electron spectra in 5.5 MeV/amu Nesup(q+) and Arsup(q+) ion impact on Ne, 11:12086 (R;SU)
Electron-Ion Collisions
Electron collisions with positive ions. Progress report, April 1, 1985-March 31, 1986, 11:12079 (R;US)
Energy-Level Transitions
EUV beam-foil spectroscopy of highly ionized argon, 11:12074 (RA;US)
Ion-Atom Collisions
Auger electron spectra in 5.5 MeV/amu Nesup(q+) and Arsup(q+) ion impact on Ne, 11:12086 (R;SU)
Ion-Molecule Collisions
Fine structure effect on the charge transfer reaction of $Ar^+ (^2P_{3/2}, ^2P_{1/2}) + N_2 (X\ ^1\Sigma^+_g, v = 0)$, 11:12099 (J;US)
AROMATIC ACIDS
See CARBOXYLIC ACIDS
AROMATIC COMPOUNDS
See AROMATICS
AROMATICS
See also ANILINE
BENZENE
CONDENSED AROMATICS
PHENOLS
POLYCYCLIC AROMATIC HYDROCARBONS

QUINONES
STILBENE
TETRALIN

Combustion
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Photoelectron Spectroscopy
Transition metal-isocyanide bonding: Photoelectron spectroscopic study of iron tetracarbonyl isocyanide complexes, 11:11659 (J;US)

Solvation
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)

ARRAY PROCESSORS

Parallel Processing
Parallel-processing a large scientific problem, 11:12526 (B;US)
Quasi-automatic parallelization: a simplified approach to multiprocessing, 11:12517 (R;US)

Simulation
Multiprocessor model with distributed task creation, 11:12524 (R;US)

ARSENIC

Activation Analysis
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)

Gel Permeation Chromatography
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)

X-Ray Fluorescence Analysis
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)

ARSENIC COMPOUNDS

Activation Analysis
Extraction of arsenic(III) and arsenic(V) from natural waters for neutron activation analysis, 11:11626 (J;US)

Mass Spectroscopy
Mass spectrometry of inductively coupled plasmas, 11:11624 (J;US)

Solvent Extraction
Extraction of arsenic(III) and arsenic(V) from natural waters for neutron activation analysis, 11:11626 (J;US)

ARSONIUM COMPOUNDS
See ARSENIC COMPOUNDS

ASHES
See also FLY ASH

Activation Analysis
Investigation of trace elements in domestic coal and its combustion products, as well as in industrial samples and ashes of special refuse by means of neutron activation analysis, 11:10801 (R;AT;In German)

Catalytic Effects
Experimental study of coal ash catalyzed reactions between carbon monoxide and hydrogen, 11:10759 (RA;US)

Chemical Composition
Evaluation of the effect of coal cleaning on fugitive elements. Phase IV. Identification of mineral forms in coal. Quarterly progress report No. 10, September 1-November 30, 1985, 11:10825 (R;US)
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Deposition
Design, cost and economic benefits of ion exchange process to remove sodium from lignite, 11:10853 (RA;US)

Melting
Crystallization behavior of coal gasification ash, 11:10805 (J;US)
On-line measurements of fouling and slagging (full-scale and pilot units) and correlation with predictive indices in conventionally fired steam generators, 11:11212 (RA;US)

Multi-Element Analysis
Investigation of trace elements in domestic coal and its combustion products, as well as in industrial samples and ashes of special refuse by means of neutron activation analysis, 11:10801 (R;AT;In German)

Waste Disposal
Environmental control technology, 11:11219 (RA;US)

Waste Product Utilization
Environmental control technology, 11:11219 (RA;US)

ASTATINE 211

Nuclear Reaction Yield
Inclusive measurement of (p,πsup(-)xn) double charge exchange reactions on bismuth from threshold to 800 MeV, 11:12344 (R;CA)

ASTROPHYSICS

Hydrodynamics
2-D Eulerian hydrodynamics with fluid interfaces, self-gravity and rotation, 11:12042 (R;US)

ATF TORSATRON

Design
Advanced Toroidal Facility, 11:12478 (R;US)

ICR Heating
ICRF antenna and feedthrough development at ORNL, 11:12428 (R;US)

Magnet Coils
Highlights from the assembly of the helical field coils for the Advanced Toroidal Facility, 11:12480 (R;US)
Mechanical testing and development of the helical field coil joint for the Advanced Toroidal Facility, 11:12481 (R;US)

Neutral Atom Beam Injection
ATF neutral beam injection: optimization of beam alignment and aperturing, 11:12497 (R;US)

Waveguides
Pure mode swept frequency TE_{01} measurements in 6.35 cm circular waveguide, 11:12484 (R;US)

ATLANTIC OCEAN
See also CHESAPEAKE BAY
SOUTH ATLANTIC BIGHT

Air-Water Interactions
Associations between summer circulation anomalies and sea surface temperature forcing, 11:11863 (R;US)

ATMOSPHERIC CHEMISTRY
Application of quantum chemistry to atmospheric chemistry. Final report, 1 October 1983-30 September 1984, 11:11639 (R;US)

ATMOSPHERIC CIRCULATION

Meteorology
General circulation variability, medium to long-range forecasting, and energy industry related applications. Final report, 1 January 1983-31 December 1985, 11:11861 (R;US)

Temperature Effects
Associations between summer circulation anomalies and sea surface temperature forcing, 11:11863 (R;US)

ATMOSPHERIC EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS

ATOM-ATOM COLLISIONS

Lennard-Jones Potential
Collision kernels in the eikonal approximation for Lennard-Jones interaction potential, 11:12084 (R;IT)

ATOMIC BOMBS
See NUCLEAR WEAPONS

ATOMIC CLOUDS
See RADIOACTIVE CLOUDS

ATOMIC EXPLOSIONS
See NUCLEAR EXPLOSIONS

ATOMIC SHELLS
See ELECTRONIC STRUCTURE

ATOMIC WEAPONS
See NUCLEAR WEAPONS

ATOM-MOLECULE COLLISIONS

Isotope Effects
Variational-transition-state theory with least-action tunneling calculations for the kinetic isotope effects in the Cl+h_2 reaction: tests of extended-leps, information-theoretic, and diatomics-in-molecules potential energy surfaces, 11:12062 (R;US)

ATOMS
See also HADRONIC ATOMS
MUONIC ATOMS
Resonance Fluorescence
To test photon statistics by atomic beam deflection, 11:12083 (R;IT)
ATTACHED GREENHOUSES
Design
Passive solar greenhouse. Final technical report, 11:11194 (R;US)
Heat Gain
Multi-family houses with built-in conservatories, 11:11414 (RA;CH;In German)
Passive Solar Heating Systems
Measurements on 2 test cabins, one with glazed veranda and one with direct energy gain, 11:11186 (RA;CH;In German)
Thermal Comfort
Multi-family houses with built-in conservatories, 11:11414 (RA;CH;In German)
AUGER ELECTRON SPECTROSCOPY
Time-resolved Auger electron spectroscopy combined with modulated molecular beam techniques for gas-surface reaction kinetics studies, 11:11662 (J;NL)
Data Analysis
Technique for comparing AES signals from different spectrometers using common materials, 11:11621 (R;US)
AUSTENITIC STEELS
Prior to February, 1978 STEELS and AUSTENITE were used to index this concept.
Fracture Properties
Precipitate formation in austenitic stainless steel welds, 11:11545 (J;US)
Mechanical Properties
Perspective on present and future alloy development efforts on austenitic stainless steels for fusion application, 11:11507 (R;US)
Sulfidation
Effect of sulfur sorbent and gas cycling on corrosion of FBC materials at 866 K, 11:10896 (R;US)
AUSTRALIA
Uranium Ores
Economics of Australian uranium mining, 11:10993 (R;XA)
AUSTRALIAN ATOMIC ENERGY COMMISSION
See AAEC
AUSTRIA
Research Programs
Physics in Austria. Results of an investigation, 11:12272 (R;AT;In German)
Report 1984. Work of the Austrian Research Center Seibersdorf in 1984, 11:11230 (R;AT;In German)
AUSTRIAN TRIGA-MARK-II REACTOR
See TRIGA-2-VIENNA REACTOR
AUTOMOBILE EFFICIENCY STANDARDS
See AUTOMOBILES
AUTOMOBILE INDUSTRY
See AUTOMOTIVE INDUSTRY
AUTOMOBILES
Meetings
Twenty-second automotive technology development contractors' coordination meeting: proceedings, 11:11485 (R;US)
AUTOMOTIVE FUELS
Alcohol Fuels
Characterization of exhaust emissions from alcohol-fueled vehicles. Final report, 11:11498 (R;US)
Fuel Consumption
Motor Fuel Consumption model. Twelfth periodical report, 11:11461 (R;US)
AUTOMOTIVE INDUSTRY
Energy Conservation
Balance sheet of success for energy saving schemes in industry, 11:11437 (RA;DE;In German)
Space HVAC Systems
Balance sheet of success for energy saving schemes in industry, 11:11437 (RA;DE;In German)
AUXINS
Biological Effects
Auxin-induced modifications of cell wall polysaccharides in cat coleoptile segments. Effect of galactose, 11:11932 (RA;US)
Cell wall proteins extracted from suspension-cultured cells, 11:11931 (RA;US)
AVOIDANCE
Effects of 60 Hz electric fields on operant and social stress behavior of nonhuman primates. Quarterly technical progress report No. 20, September 28-December 20, 1985, 11:12016 (R;US)
AZEOTROPE
Distillation
Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)
AZIDES
For inorganic compounds only. For organic azides, use AZIDO COMPOUNDS.
Chemical Preparation
Preparation of $Yb[N(SiMe_3)_2]_3[AiMe_3]_3$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
Crystal Structure
Preparation of $Yb[N(SiMe_3)_2]_3[AiMe_3]_3$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
AZINES
Chemical Preparation
New method of synthesizing stilbene compounds with heterocyclic substituents, anil synthesis, 11:11698 (TJ;US)
AZOLES
See also CARBAZOLES
PYRROLES
Chemical Preparation
New method of synthesizing stilbene compounds with heterocyclic substituents, anil synthesis, 11:11698 (TJ;US)

B

B MESONS
Radiative Decay
JADE: search for new particles and tests of Standard Model, 11:12146 (RA;US)
BABCOCK AND WILCOX-DUPONT PROCESS
Comparative Evaluations
Surface gasification data system: feasibility studies overview report, 11:10778 (R;US)
BABOONS
Behavior
Effects of 60 Hz electric fields on operant and social stress behavior of nonhuman primates. Quarterly technical progress report No. 20, September 28-December 20, 1985, 11:12016 (R;US)
BACON
See MEAT
BAG MODEL
Solitons
Dynamics of six-quark systems in the soliton bag model, 11:12361 (R;US)
Soliton Bag Model, 11:12225 (R;US)
BAGASSE
Pyrolysis
Pyrolysis of sugar cane bagasse, 11:11125 (RA;PR)
BALLOONS
Technology Assessment
Energy recovered by using balloons and cylinders, 11:11207 (RA;PR)
BANKS
See COMMERCIAL BUILDINGS
BARGES
Cleaning
Coal water slurry barge delivery to Boston Edison Mystic 4 for a demonstration test burn, 11:10849 (RA;US)

Unloading
Coal water slurry barge delivery to Boston Edison Mystic 4 for a demonstration test burn, 11:10849 (RA;US)

BARIUM 132
Vibrational States
Octupole vibrational states in the even-mass barium isotopes, 11:12326 (R;AU)

BARIUM 134
Vibrational States
Octupole vibrational states in the even-mass barium isotopes, 11:12326 (R;AU)

BARIUM 136
Vibrational States
Octupole vibrational states in the even-mass barium isotopes, 11:12326 (R;AU)

BARIUM 138
Vibrational States
Octupole vibrational states in the even-mass barium isotopes, 11:12326 (R;AU)

BARSTOW SOLAR PILOT PLANT
10-MW solar central receiver pilot plant at Barstow, California.
Cost
Cost Data Management System. CDMS Version 2.2. Final report, 11:11155 (R;US)

BARYON NUMBER
Conservation Laws
Anomalous electroweak baryon number non-conservation in the early universe, 11:12183 (R;IT)

BARYON NUMBER 2 RESONANCES
See DIBARYON RESONANCES

BARYON-BARYON INTERACTIONS
See also NUCLEON-ANTINUCLEON INTERACTIONS
NUCLEON-NUCLEON INTERACTIONS
Skyrme Potential
Static baryon-baryon potential in the Skyrme model, 11:12158 (R;FR)

BARYONS
See also HYPERONS
LAMBDA C PLUS
NUCLEONS
Three-Body Problem
Study of light baryons in the three quark cluster model: exact calculations, 11:12195 (R;FR)

BASALT
Disposal materials study, 11:11034 (R;US)
Rock-Fluid Interactions
Hydrothermal studies of simulated defense waste glass plus basalt, 11:11030 (R;US)

BATTELLE RESEARCH REACTOR
See BRR REACTOR

BATTERIES (ELECTRIC)
See ELECTRIC BATTERIES

BEAM DUMPS
Crack Propagation
Review of failure criteria for thin wall structures in a high heat flux environment, 11:12508 (R;US)

BEAM DYNAMICS
Particle dynamics for motion in a non-planar accelerator, 11:11789 (R;US)

BEAM MONITORING
X-Ray Diffractometers
Curved crystal spectrometer of Johansson type, 11:11804 (RA;SU;In Russian)

BEAM MONITORS
Design
Proton beam position and intensity monitors, 11:11787 (RA;US)
Performance
Proton beam position and intensity monitors, 11:11787 (RA;US)

BEAM NEUTRALIZATION
Plasma Simulation
Current neutralization of intense light ion beams in argon gas, 11:12502 (R;US)

BEAM PROFILES
Measuring Methods
Holographic wavefront characterization of a frequency-tripled high-peak-power neodymium:glass laser (Near-field, $\lambda = 351$ nm), 11:11756 (R;US)

BEAM WIDTHS
See BEAM PROFILES

BEAM-PLASMA SYSTEMS
Research Programs
Status report on the plasma-particle beam interaction experiment at Bruyeres-le-Chatel, 11:12475 (R;US)

BEEF
See MEAT

BENTHOS
Environmental Effects
Predicting the effect of macro-benthos on the sediment/water flux of metals and phosphorus, 11:11912 (J;CA)

BENTONITE
Radiation Effects
Observations regarding the stability of bentonite backfill in a high-level waste (HLW) repository in rock salt, 11:11585 (R;US)
Stability
Observations regarding the stability of bentonite backfill in a high-level waste (HLW) repository in rock salt, 11:11585 (R;US)

BENZENE
Dissociation
Investigations on multiphoton ionization and laser-ion beam photodissociation spectroscopy. Final report, 11:11702 (R;US)
Elutriation
Elution of benzene and methyl ethyl ketone from charcoal beds by continued air sweeping. Interim report, March 1983-November 1984, 11:11782 (R;US)
Isomerization
Investigations on multiphoton ionization and laser-ion beam photodissociation spectroscopy. Final report, 11:11702 (R;US)
Labelling
Mechanism of tritium-atom promoted isotope exchange in the benzene ring. 2. Substituent effects and a crossover in labelling mechanism, 11:11693 (J;US)
Molecular Structure
Structure and thermochemistry of the van der Waals molecule C_6H_6xHCl and its photoion $(C_6H_6xHCl)^+$, 11:11679 (J;US)
Phase Diagrams
Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)
Photoionization
Structure and thermochemistry of the van der Waals molecule C_6H_6xHCl and its photoion $(C_6H_6xHCl)^+$, 11:11679 (J;US)
Piezometry
Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)
Thermodynamic Activity
Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)

BENZOFURANS
Hydrogenation
Catalytic hydrotreatment studies with model compounds. Quarterly report, October 1, 1985-December 31, 1985, 11:10781 (R;US)

BENZOIC ACID
Adsorption
Surface-enhanced Raman spectroscopy: a new tool for chemical detection, 11:11608 (R;US)
Raman Spectroscopy
Surface-enhanced Raman spectroscopy: a new tool for chemical detection, 11:11608 (R;US)

BENZOPYRENE
Adducts
Biochemical studies on the mechanism of benzo(a)pyrene binding to cellular macromolecules. Progress report, 11:12007 (R;US)

Metabolism
Detoxication mechanisms of benzo(a)pyrene as studied in the CHO/HGPRT assay, 11:12006 (R;US)
BENZOPYRROLES
See INDOLES
BENZOXAZOLES
Chemical Preparation
New method of synthesizing stilbene compounds with heterocyclic substituents, anil synthesis, 11:11698 (TJ;US)
BERYLLIA
See BERYLLIUM OXIDES
BERYLLIUM
Proton Reactions
Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)
BERYLLIUM 10
Nuclear Radii
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
BERYLLIUM 7
Nuclear Radii
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
BERYLLIUM 9 REACTIONS
Cross Sections
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
BERYLLIUM 9 TARGET
Alpha Reactions
Emission of light fragments ^{3}H, ^{3}He and ^{4}He in ^{4}He-nucleus collisions at 3.33 GeV/N kinetic energy, 11:12369 (R;SU)
Beryllium 9 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Lithium 6 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Lithium 7 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Lithium 8 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Neutron Reactions
A reevaluation of the $^{9}Be(n,2n)$ reaction and its effect on neutron multiplication in fusion blanket applications, 11:12309 (J;US)
BERYLLIUM ALLOYS
Collective Excitations
Observation of a collective mode in superconducting UBe_{13}, 11:11536 (J;US)
Electron Spin Resonance
ESR in a heavy-fermion alloy (UBe_{13}) doped with local moments, 11:11535 (J;US)
BERYLLIUM MODERATORS
See BERYLLIUM
BERYLLIUM OXIDES
X-Ray Spectra
Ion-excited K X-ray spectra of oxygen, 11:12076 (RA;US)
BESSEL DIFFERENTIAL EQUATION
See FOKKER-PLANCK EQUATION
BETA BEAMS (ELECTRONS)
See ELECTRON BEAMS
BETA BEAMS (POSITRONS)
See POSITRON BEAMS
BETA DECAY
For neutron and nuclear decay.
Neutrinos
Rate suppression with three generations of Majorana neutrinos, 11:12208 (R;CA)
BETA DOSIMETRY
Computer Codes
New Monte Carlo electron transport code for beta dosimetry (BETRA code), 11:11830 (RA;AT)
Thermoluminescent Dosemeters
New Monte Carlo electron transport code for beta dosimetry (BETRA code), 11:11830 (RA;AT)
BEVERAGES
Freezing
Tests on deep-freeze reactions of liquid foods using pulsed NMR spectroscopy, 11:11117 (RA;DE;In German)
Quantitative Chemical Analysis
Tests on deep-freeze reactions of liquid foods using pulsed NMR spectroscopy, 11:11117 (RA;DE;In German)
BINARY ALLOY SYSTEMS
Electric Conductivity
Structure of the scattering diagrams for conductivity in random binary alloys and the self-consistent CCPA, 11:11520 (R;IT)
BINARY MIXTURES
Critical Temperature
Critical behavior of binary liquid mixtures of deuterated and protonated polymers, 11:12135 (J;US)
Deuteration
Critical behavior of binary liquid mixtures of deuterated and protonated polymers, 11:12135 (J;US)
Hydrogenation
Critical behavior of binary liquid mixtures of deuterated and protonated polymers, 11:12135 (J;US)
BIOGAS
See METHANE
BIOLOGICAL DOSEMETERS
Comparative studies of the dose-response relationship of radiation-induced chromosomal aberrations in human lymphocytes induced by low radiation doses, using Feulgen orcein glacial acetic acid and FPG staining, 11:11996 (R;DE;In German)
BIOLOGICAL REACTORS
See BIOREACTORS
BIOLOGICAL STRESS
Physiology
Pectic fragments of plant cell walls as mediators of stress responses, 11:11934 (RA;US)
BIOMASS
Fuel Substitution
Biomass fuel use in agriculture under alternative fuel prices, 11:11133 (J;US)
Gasification
Low-temperature thermochemical conversion of high-moisture biomass feedstocks, 11:11132 (R;US)
Research Programs
Hawaii Natural Energy Institute annual report, July 1982-June 1983, 11:11405 (R;US)
Hawaii Natural Energy Institute annual report, July 1981-June 1982, 11:11383 (R;US)
Hawaii Natural Energy Institute annual report, 1984, 11:11384 (R;US)
Vegetables
Production of alcohol from Jerusalem artichoke for gasoline additive, 11:11143 (R;US)
BIOMASS PLANTATIONS
Economic Analysis
Economic analysis method for short-rotation forestry, 11:11158 (RA;PR)
BIOREACTORS
Prior to March 1983 this concept was indexed to CHEMICAL REACTORS.
Performance Testing
Conversion of food processing wastes into ethanol using a novel biological reactor/separator. Final report, September 1, 1984-September 30, 1985, 11:11139 (R;US)
BIPYRIDINES
Chemical Preparation
Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)
Electrochemistry
Relationships between electronic spectroscopy and electrochemistry. A probe of reorganisation energies. Technical report, 11:11638 (R;CA)
Electron Spectroscopy
Relationships between electronic spectroscopy and electrochemistry. A probe of reorganisation energies. Technical report, 11:11638 (R;CA)

Photochemistry
Excited state photoelectrochemical production of H_2O_2 and Br_2, 11:11175 (J;GB)
Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)
BISMUTH 209 TARGET
Neutron Reactions
Low-energy optical-model analysis of ^{208}Pb and ^{209}Bi, 11:12345 (J;NL)
Proton Reactions
Inclusive measurement of (p,πsup(-)xn) double charge exchange reactions on bismuth from threshold to 800 MeV, 11:12344 (R;CA)
BISMUTH COMPOUNDS
See also BISMUTH OXIDES
Solid Solutions
Substantial solid solutions of bismuth-containing lanthanide dititanates, Ln/sub 2-x/Bi/sub x/Ti_2O_7, 11:11564 (J;US)
BISMUTH OXIDES
Catalytic Effects
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)
BITUMINOUS COAL
Ash Content
Characterization of coal surfaces. Technical progress report, August 21-November 20, 1985, 11:10856 (R;US)
Chemical Composition
Characterization of coal surfaces. Technical progress report, August 21-November 20, 1985, 11:10856 (R;US)
Kinetics of coal pyrolysis and devolatilization. Technical progress report, August 1, 1985-October 31, 1985, 11:10784 (R;US)
Flotation
Characterization of coal surfaces. Technical progress report, August 21-November 20, 1985, 11:10856 (R;US)
Heavy Media Separation
Chlorinated solvents for coal beneficiating, 11:10829 (RA;US)
Infrared Spectra
Kinetics of coal pyrolysis and devolatilization. Technical progress report, August 1, 1985-October 31, 1985, 11:10784 (R;US)
Oxidation
Characterization of coal surfaces. Technical progress report, August 21-November 20, 1985, 11:10856 (R;US)
Particle Size
Kinetics of coal pyrolysis and devolatilization. Technical progress report, August 1, 1985-October 31, 1985, 11:10784 (R;US)
Pyrolysis
Kinetics of coal pyrolysis and devolatilization. Technical progress report, August 1, 1985-October 31, 1985, 11:10784 (R;US)
Surface Properties
Characterization of coal surfaces. Technical progress report, August 21-November 20, 1985, 11:10856 (R;US)
Wettability
Characterization of coal surfaces. Technical progress report, August 21-November 20, 1985, 11:10856 (R;US)
BLADES (COMPRESSOR)
See COMPRESSOR BLADES
BLADES (TURBINES)
See TURBINE BLADES
BLANKETS (BREEDING)
See BREEDING BLANKETS
BLOOD
Quantitative Chemical Analysis
New laser spectroscopic technique for stable-isotope ratio analysis, 11:11636 (D;US)
BLOWDOWN
Heat Transfer
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
Hydraulics
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
BMI REACTOR
See BRR REACTOR
BNL
Research Programs
Objective of the NRC high-level research program at BNL, 11:11054 (J;US)
BOHUNICE V-1 REACTOR
Trnava, West Slovakia, Czechoslovakia
Data Acquisition
Experience from data acquisition for assessment of component life in V-1 nuclear power plant, 11:11251 (RA;CS;In Slovak)
Equipment
In-service monitoring of reliability of V-1 nuclear power plant equipment, 11:11320 (RA;CS;In Slovak)
Failures
In-service monitoring of reliability of V-1 nuclear power plant equipment, 11:11320 (RA;CS;In Slovak)
Information analysis and dissemination system of safety significant nuclear power plant failures, 11:11322 (RA;CS;In Slovak)
Information Systems
Information analysis and dissemination system of safety significant nuclear power plant failures, 11:11322 (RA;CS;In Slovak)
Monitoring
In-service monitoring of reliability of V-1 nuclear power plant equipment, 11:11320 (RA;CS;In Slovak)
Primary Coolant Circuits
Experience from data acquisition for assessment of component life in V-1 nuclear power plant, 11:11251 (RA;CS;In Slovak)
Reactor Safety
Information analysis and dissemination system of safety significant nuclear power plant failures, 11:11322 (RA;CS;In Slovak)
Reliability
Experience from monitoring reliability of V-1 nuclear power plant, 11:11248 (RA;CS;In Slovak)
In-service monitoring of reliability of V-1 nuclear power plant equipment, 11:11320 (RA;CS;In Slovak)
Secondary Coolant Circuits
Experience from data acquisition for assessment of component life in V-1 nuclear power plant, 11:11251 (RA;CS;In Slovak)
Service Life
Experience from data acquisition for assessment of component life in V-1 nuclear power plant, 11:11251 (RA;CS;In Slovak)
BOILERS
See also FLUIDIZED BED BOILERS
Air Pollution
Coal-water mixture firing in an industrial package boiler: a user's perspective, 11:10887 (RA;US)
Combustion tests of beneficiated and micronized coal-water fuels: use of internal-mix atomizer and rotary-cup burner, 11:10886 (RA;US)
Pilot-scale combustion tests of CWM for a modified water-tube package oil boiler at KIER (Coal water mixtures; Korea Institute of Energy and Resources), 11:10875 (RA;US)
Sundbyberg coal water fuel fired boiler - experiences gained between the 6th and 7th International Symposium on Coal Slurry Fuels, 11:10888 (RA;US)
Corrosion
Predicting and assessing tube metal wastage in boilers fired with low-rank coal, 11:11213 (RA;US)
Design
Design, cost and economic benefits of ion exchange process to remove sodium from lignite, 11:10853 (RA;US)
Modelling of heat transfer and furnace conditions in pulverised coal fired boilers, 11:11214 (RA;US)
NO/sub x/ formation and control in pulverized-coal flames, 11:11221 (RA;US)
Efficiency
Achieving high combustion efficiency burning coal-water fuels, 11:10862 (RA;US)

Coal-water-fuel firing experience at Chatham #2, 11:10890 (RA;US)
Coal-water fuel developments in eastern Canada: the Chatham and Charlottetown demonstrations and beyond, 11:10891 (RA;US)
Combustion tests of beneficiated and micronized coal-water fuels: use of internal-mix atomizer and rotary-cup burner, 11:10886 (RA;US)
Experimental study on coal-water slurry combustion on a 20t/h oil-fired boiler, 11:10889 (RA;US)
Pilot-scale combustion tests of CWM for a modified water-tube package oil boiler at KIER (Coal water mixtures; Korea Institute of Energy and Resources), 11:10875 (RA;US)
Scale-up of coal water fuels experiments in pilot furnaces for evaluation of utility boiler performance, 11:10868 (RA;US)

Erosion
Performance characteristic of coal-water fuels and their impact on boiler operation, 11:10893 (RA;US)

Fouling
Environmental control technology, 11:11219 (RA;US)
Modelling of heat transfer and furnace conditions in pulverised coal fired boilers, 11:11214 (RA;US)
On-line measurements of fouling and slagging (full-scale and pilot units) and correlation with predictive indices in conventionally fired steam generators, 11:11212 (RA;US)
Performance characteristic of coal-water fuels and their impact on boiler operation, 11:10893 (RA;US)
Sodium in low-rank coal, 11:10797 (R;US)

Heat Exchangers
Condensing heat exchanger systems for residential/commercial furnaces and boilers. Phase IV, 11:11413 (R;US)

Heat Transfer
Modelling of heat transfer and furnace conditions in pulverised coal fired boilers, 11:11214 (RA;US)

Performance
Coal-water mixture firing in an industrial package boiler: a user's perspective, 11:10887 (RA;US)
Experimental study on coal-water slurry combustion on a 20t/h oil-fired boiler, 11:10889 (RA;US)
Performance characteristic of coal-water fuels and their impact on boiler operation, 11:10893 (RA;US)
Sundbyberg coal water fuel fired boiler - experiences gained between the 6th and 7th International Symposium on Coal Slurry Fuels, 11:10888 (RA;US)

Performance Testing
Coal-water fuel developments in eastern Canada: the Chatham and Charlottetown demonstrations and beyond, 11:10891 (RA;US)
Demonstration and various test applications of COM in Israel (Coal oil mixtures), 11:10834 (RA;US)

Retrofitting
Coal-water mixture firing in an industrial package boiler: a user's perspective, 11:10887 (RA;US)
Experimental study on coal-water slurry combustion on a 20t/h oil-fired boiler, 11:10889 (RA;US)
Retrofit considerations for adding coal-water-mixture fuel capability at Houston Lighting and Power's Sam Bertron Plant, 11:10894 (RA;US)

Supercritical Gas Extraction
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)

BOILING WATER COOLED AND MODERATED REACTO
See BWR TYPE REACTORS

BOLTED JOINTS
Mechanical Tests
Mechanical testing and development of the helical field coil joint for the Advanced Toroidal Facility, 11:12481 (R;US)

BONE TISSUES
Irradiation
Sterilization of human bone by irradiation. Final report, 11:11991 (R;US)
Sterilization
Sterilization of human bone by irradiation. Final report, 11:11991 (R;US)

BONES
See SKELETON

BONNEVILLE POWER ADMINISTRATION
Power Distribution Systems
The application of synchronous clocks for power system fault location, control and protection, 11:11224 (BA;US)

BOOTSTRAP MODEL
Baryonium
From baryonium to hexons, 11:12194 (R;FR)

BOREHOLE LINKING
See also ELECTROLINKING
Field Tests
Proven directional drilling techniques tested in Texas lignite, 11:10748 (RA;US)
Operating Cost
Proven directional drilling techniques tested in Texas lignite, 11:10748 (RA;US)

BORON
Activation Analysis
Activation analysis, 11:11609 (RA;US)
Leaching
Hydrothermal studies of simulated defense waste glass plus basalt, 11:11030 (R;US)
Microanalysis
Microanalytical techniques for boron analysis using the $^{10}B(n,\alpha)^{7}Li$ reaction, 11:11981 (J;US)

BORON 10 TARGET
Proton Reactions
Polarized proton induced pion production on ^{10}B at 200, 225, 250 and 260 MeV incident energies, 11:12305 (R;CA)
sup(10,11) B(p, n) sup(10,11) C reaction between E sub(p) = 13.6 and 14.7 MeV, 11:12298 (R;BR)

BORON 11 TARGET
Proton Reactions
sup(10,11) B(p, n) sup(10,11) C reaction between E sub(p) = 13.6 and 14.7 MeV, 11:12298 (R;BR)

BORON CHLORIDES
Chemical Reactions
Removal of oxide contamination from silicon carbide powders, 11:11565 (J;US)

BORON COMPOUNDS
See also BORON CHLORIDES
Chemical Preparation
Chemoradiotherapy of cancer: boronated antibodies and boron-containing derivatives of promazine and porphyrins for neutron capture therapy. Progress report, November 1984-October 1985, 11:11973 (R;US)

BOROSILICATE GLASS
Hydrothermal Alteration
Hydrothermal studies of simulated defense waste glass plus basalt, 11:11030 (R;US)
Leaching
Hydrothermal studies of simulated defense waste glass plus basalt, 11:11030 (R;US)

BOROSILICATES
See BOROSILICATE GLASS

BOSONS
See also MESONS
Decay
Signatures for horizontal gauge bosons in very energetic hadronic collisions, 11:12213 (J;US)
Particle Production
Signatures for horizontal gauge bosons in very energetic hadronic collisions, 11:12213 (J;US)

BOTTOM MESONS
See B MESONS

BPA
See BONNEVILLE POWER ADMINISTRATION

BRACKISH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS

BRAKING RADIATION
See BREMSSTRAHLUNG

BRAZIL
Energy Policy
Vegetable oils as substitutes for diesel oil, 11:11127 (RA;PR)

BREEDING BLANKETS
Reviews
Review of fusion breeder blanket technology. Part 1. Review and findings, December 1984, 11:12476 (R;CA)
Transmutation
Neutron activation in Cascade: the BeO/$LiAlO_2$ case, 11:12507 (R;US)
BREMSSTRAHLUNG
Mathematical Models
Comparison of models for the free-free Gaunt factor at low temperatures and frequencies, 11:12384 (R;US)
Reviews
Radiative reactions in two and three nucleon systems, 11:12288 (R;CA)
BRINES
Additives
Field test of drag reducing agents in a three-inch pipeline at the West Hackberry, Louisiana SPR site, 11:10957 (R;US)
Fluid Flow
Field test of drag reducing agents in a three-inch pipeline at the West Hackberry, Louisiana SPR site, 11:10957 (R;US)
Heat Transfer
Effective heat transfer in the Strategic Petroleum Reserve porous media, 11:10956 (R;US)
Refractivity
Interferometric measurement techniques in double-diffusive systems. Technical progress report, 11:11643 (R;US)
Waste Disposal
Field test of drag reducing agents in a three-inch pipeline at the West Hackberry, Louisiana SPR site, 11:10957 (R;US)
BROMINE COMPOUNDS
Mass Spectroscopy
Mass spectrometry of inductively coupled plasmas, 11:11624 (J;US)
BROOKHAVEN NATIONAL LABORATORY
See BNL
BRR REACTOR
Radiation Monitoring
Monitoring of airborne radioactivity at Austrian and Hungarian nuclear training reactors, 11:11278 (RA;AT)
Radioactive Effluents
Monitoring of airborne radioactivity at Austrian and Hungarian nuclear training reactors, 11:11278 (RA;AT)
BUBBLES
Size
Advanced physical fine coal cleaning microbubble flotation. Topical report No. 1. GHH-Bergbau Forschung microbubble coal flotation machine, 11:10857 (R;US)
BUCKLING (STRUCTURAL)
See DEFORMATION
BUILDING MATERIALS
Radioactivity
Radioactive substances in building materials. A compilation of results from samples examined at SSI, 11:12392 (R;SE;In Swedish)
Radionuclide Migration
Progress in indoor radon measurement. Review of previous research (July 1981-February 1985), 11:11881 (R;US)
BUILDINGS
See also COMMERCIAL BUILDINGS
CONTAINMENT BUILDINGS
DOUBLE ENVELOPE BUILDINGS
FEDERAL BUILDINGS
GREENHOUSES
LABORATORY BUILDINGS
OFFICE BUILDINGS
PREFABRICATED BUILDINGS
PUBLIC BUILDINGS
RESIDENTIAL BUILDINGS
SCHOOL BUILDINGS
Energy Conservation
Energy savings and building technology, 11:11438 (RA;DE;In German)
Influence of the way the process is carried out on the economic efficiency of indoor air conditioning equipment - a practice report, 11:11434 (RA;DE;In German)
Modernisation of the energy engineering in large buildings, as in the example of Freiburg University, 11:11433 (RA;DE;In German)
Quantifiability of energy savings, 11:11430 (RA;DE;In German)
Report on DKV annual meeting 1984. Vol. 11, 11:11422 (R;DE;In German)
Window performance and building energy use: some technical options for increasing energy efficiency, 11:11454 (J;US)
Energy Efficiency
Energy sources: conservation and renewables, 11:11450 (B;US)
Lighting Systems
Energy and lighting, 11:11453 (J;US)
Retrofitting
Modernisation of the energy engineering in large buildings, as in the example of Freiburg University, 11:11433 (RA;DE;In German)
Solar Space Heating
Passive solar heating research, 11:11196 (BA;US)
Space HVAC Systems
Energy savings and building technology, 11:11438 (RA;DE;In German)
Influence of the way the process is carried out on the economic efficiency of indoor air conditioning equipment - a practice report, 11:11434 (RA;DE;In German)
Report on DKV annual meeting 1984. Vol. 11, 11:11422 (R;DE;In German)
Windows
Window performance and building energy use: some technical options for increasing energy efficiency, 11:11454 (J;US)
BUILDINGS (CONTAINMENT)
See CONTAINMENT BUILDINGS
BUNDLES (FUEL ELEMENTS)
See FUEL ELEMENT CLUSTERS
BUNKER OILS
See RESIDUAL FUELS
BUREAU OF MINES
See US BUREAU OF MINES
BURNER FUEL OIL
See HEATING OILS
BURNERS
Design
Coal-water-fuel firing experience at Chatham #2, 11:10890 (RA;US)
Combustion trials on coal water slurry and petroleum coke water slurry, 11:10872 (RA;US)
Combustion tests of beneficiated and micronized coal-water fuels: use of internal-mix atomizer and rotary-cup burner, 11:10886 (RA;US)
Comparison of the performance of a cross-section of commercial CWF burners (Coal water fuel), 11:10877 (RA;US)
NO/sub x/ formation and control in pulverized-coal flames, 11:11221 (RA;US)
Performance
Comparison of the performance of a cross-section of commercial CWF burners (Coal water fuel), 11:10877 (RA;US)
Experience with the NRC burner assembly, 11:10881 (RA;US)
Performance Testing
Coal-water-fuel firing experience at Chatham #2, 11:10890 (RA;US)
Coal-water fuel developments in eastern Canada: the Chatham and Charlottetown demonstrations and beyond, 11:10891 (RA;US)
Combustion tests of beneficiated and micronized coal-water fuels: use of internal-mix atomizer and rotary-cup burner, 11:10886 (RA;US)
BUTADIENE
Critical Temperature
Critical behavior of binary liquid mixtures of deuterated and protonated polymers, 11:12135 (J;US)
Deuteration
Critical behavior of binary liquid mixtures of deuterated and protonated polymers, 11:12135 (J;US)
Hydrogenation
Critical behavior of binary liquid mixtures of deuterated and protonated polymers, 11:12135 (J;US)

BUTANE
Electron Mobility
Effect of high pressure on the electron mobility in liquid n-hexane, 2,2-dimethylbutane, and tetramethylsilane, 11:11686 (J;US)
Viscosity
Thermophysical properties correlations and pseudocomponent characterization parameter estimation for fossil fluids. First quarterly report (III year), September 1-November 30, 1985, 11:11674 (R;US)
BUTANOLS
Photochemical Reactions
Assessment of photochemical applications to specific stages in Savannah River Plant actinide reprocessing streams, 11:10988 (R;US)
BUTTER FAT
Supercritical Fluid Chromatography
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)
BUTYL ALCOHOLS
See BUTANOLS
BUTYRIC ALCOHOLS
See BUTANOLS
BWR TYPE REACTORS
See also GE STANDARD REACTOR
HOPE CREEK-1 REACTOR
HOPE CREEK-2 REACTOR
RIVER BEND-1 REACTOR
ATWS
Evaluation of ATWS core damage frequency for an earlier vintage BWR/4, 11:11292 (R;US)
Overview of TRAC-BD1/MOD1 assessment studies, 11:11337 (R;US)
RAMONA-3B application to Browns Ferry ATWS, 11:11298 (R;US)
Containment Systems
Estimates of early containment loads from core melt accidents. Draft report for comment, 11:11325 (R;US)
Probabilistic risk assessment of filtered-vented containment systems. Mark I BWR, 11:11345 (R;US)
Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels, 11:11348 (R;US)
Two-dimensional empirical model for analyzing steam explosion experiments, 11:11344 (R;US)
Cost
Breeder reactor economics, 11:11265 (R;US)
Economics
Breeder reactor economics, 11:11265 (R;US)
Engineered Safety Systems
Emergency diesel generator operating experience, 1981-1983, 11:11235 (R;US)
Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)
Fuel Assemblies
Trends in thermal calculations for light water reactor fuel (1971-1981), 11:11238 (R;US)
Fuel Element Clusters
MELPROG analysis of the DF-1 severe core damage experiment, 11:11352 (R;US)
Fuel Rods
Fuel Performance Improvement Program. Progress report, April 1984-March 1985, 11:11232 (R;US)
Fuel-Coolant Interactions
Evaluation of the bases for estimating alpha-mode failure probabilities, 11:11350 (R;US)
Recent intermediate-scale experiments on fuel-coolant interactions in an open geometry (EXO-FITS), 11:11351 (R;US)
In Core Instruments
Use of fuel-thermocouple scram response for data verification, 11:11237 (R;US)
Loss of Coolant
Overview of TRAC-BD1/MOD1 assessment studies, 11:11337 (R;US)
TRAC-P1A independent assessment, 1979, 11:11326 (R;US)
Meltdown
Estimates of early containment loads from core melt accidents. Draft report for comment, 11:11325 (R;US)
Evaluation of the bases for estimating alpha-mode failure probabilities, 11:11350 (R;US)
Liquid jet breakup characterization with application to melt-water mixing, 11:11295 (R;US)
MELPROG analysis of the DF-1 severe core damage experiment, 11:11352 (R;US)
MELRPI - development and use, 11:11301 (R;US)
Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels, 11:11348 (R;US)
Two-dimensional empirical model for analyzing steam explosion experiments, 11:11344 (R;US)
Personnel
Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)
Pipes
BWR pipe crack and weld clad overlay studies, 11:11231 (R;US)
Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)
Pressure Vessels
ORVIRT.PC: a 2-D finite-element fracture analysis program for a microcomputer, 11:11236 (R;US)
Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)
Reactor Accidents
Probabilistic risk assessment of filtered-vented containment systems. Mark I BWR, 11:11345 (R;US)
Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)
Reactor Components
Aging/Systems Interaction Study, Component Residual Lifetime Evaluation and Feasibility of Relicensing. Progress report, FY 1985, 11:11233 (R;US)
BWR pipe crack and weld clad overlay studies, 11:11231 (R;US)
Reactor Cooling Systems
Comparative analysis of constitutive relations in TRAC-PF1 and RELAP5/MOD1, 11:11234 (R;US)
Impact of mechanical- and maintenance-induced failures of main reactor coolant pump seals on plant safety, 11:11336 (R;US)
Reactor Core Disruption
Evaluation of ATWS core damage frequency for an earlier vintage BWR/4, 11:11292 (R;US)
Reactor Cores
Overview of TRAC-BD1/MOD1 assessment studies, 11:11337 (R;US)
Reactor Decommissioning
Decommissioning a boiling water reactor nuclear power plant, 11:11339 (R;US)
Reactor Dismantling
Decommissioning a boiling water reactor nuclear power plant, 11:11339 (R;US)
Reactor Instrumentation
Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)
Reactor Materials
BWR pipe crack and weld clad overlay studies, 11:11231 (R;US)
Reactor Operation
Use of fuel-thermocouple scram response for data verification, 11:11237 (R;US)
Reactor Protection Systems
Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)
Reactor Safety
Reactor safety research semiannual report, January-June 1985. Volume 33, 11:11333 (R;US)
Risk Assessment
Probabilistic risk assessments modeled on a micro-computer, 11:11342 (R;US)
Scram
Use of fuel-thermocouple scram response for data verification, 11:11237 (R;US)

Spent Fuel Elements
Behavior of breached light water reactor spent fuel rods in air and inert atmospheres at 229°C, 11:11047 (J;US)
Valves
RAMONA-3B application to Browns Ferry ATWS, 11:11298 (R;US)
BWR
6 TYPE REACTORS
See GE STANDARD REACTOR

C

C-2260 RESONANCES
See LAMBDA C PLUS
CADMIUM 108
Moment of Inertia
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
Rotational States
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
CADMIUM SELENIDES
Photoluminescence
Photoluminescent response of palladium-cadmium sulfide and palladium-graded cadmium sulfoselenide Schottky diodes to molecular hydrogen. Technical report, 11:11571 (R;US)
CADMIUM SULFIDE SOLAR CELLS
Photoluminescence
Photoluminescence of $CuInSe_2$ photovoltaic cells. Final subcontract report, 1 April 1984-31 March 1985, 11:11167 (R;US)
CADMIUM SULFIDES
Electrodeposition
Electrodeposition of p-CdTe and CdS/CdTe heterojunction devices. Final subcontract report, September 1983-May 1985, 11:11589 (R;US)
Photoluminescence
Photoluminescent response of palladium-cadmium sulfide and palladium-graded cadmium sulfoselenide Schottky diodes to molecular hydrogen. Technical report, 11:11571 (R;US)
CADMIUM TELLURIDE SOLAR CELLS
Fabrication
Electrodeposition of p-CdTe and CdS/CdTe heterojunction devices. Final subcontract report, September 1983-May 1985, 11:11589 (R;US)
CADMIUM TELLURIDES
Electrodeposition
Electrodeposition of p-CdTe and CdS/CdTe heterojunction devices. Final subcontract report, September 1983-May 1985, 11:11589 (R;US)
CALCIUM
Removal
Two-stage liquefaction catalyst evaluation. Final report, 11:10789 (R;US)
CALCIUM 40 TARGET
Antiproton Reactions
Antiproton-nucleon physics at LEAR, 11:12284 (R;FR;In French)
Near/far decomposition of the proton-nucleus and antiproton-nucleus elastic scattering angular distributions, 11:12320 (R;BR)
Calcium 40 Reactions
Do collective effects exist in the intra-nuclear cascade, 11:12316 (R;FR;In French)
Carbon 12 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
Proton Reactions
Intermediate energy nucleon-nucleus total reaction cross section in the Dirac phenomenology, 11:12318 (R;BR)
Near/far decomposition of the proton-nucleus and antiproton-nucleus elastic scattering angular distributions, 11:12320 (R;BR)
Reactive content of the proton-nucleus impulse - approximation Dirac optical potential, 11:12319 (R;BR)
CALCIUM CARBONATES
Chemical Reactions
Interaction of uranyl ions in carbonate media, 11:11727 (J;NL)
CALCIUM CHLORIDES
Enthalpy
Enthalpies of dilution of aqueous calcium chloride to low molalities at high temperatures, 11:11660 (J;US)
CALCIUM OXIDES
Chemical Preparation
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6$O/sub 2-0.5x/ system, 11:11651 (J;US)
Lattice Parameters
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6$O/sub 2-0.5x/ system, 11:11651 (J;US)
Neutron Diffraction
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6$O/sub 2-0.5x/ system, 11:11651 (J;US)
X-Ray Diffraction
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6$O/sub 2-0.5x/ system, 11:11651 (J;US)
CALIBRATION STANDARDS
Accuracy
ISPO Task A-126: application of mixed internal standards to the mass spectrometric analysis of plutonium and uranium in spent fuel dissolver solutions: ORNL results, 11:11721 (R;US)
CALIFORNIA
Demonstration Programs
Opportunities for biomass energy projects in the State of California, 11:11124 (RA;PR)
Seismicity
Seismicity rates for East Bay faults, 11:12032 (R;US)
Slurry Pipelines
Western Resource Transport project: a liquid carbon dioxide/coal slurry pipeline, 11:10850 (RA;US)
CALIFORNIUM 248
Spin
Anomalously broad spin distributions in sub-barrier fusion reactions, 11:12351 (R;US)
CALIFORNIUM 252
Spontaneous Fission
Prompt neutron energy spectrum for the spontaneous fission of Cf-252, 11:12354 (R;XA)
CALORIMETERS
Performance
Measurement control assessment of radiometric calorimeters using nonstandards based indicators, 11:11096 (J;US)
CALORIMETERS (PARTICLE)
See SHOWER COUNTERS
CALUTRONS
See ELECTROMAGNETIC ISOTOPE SEPARATORS
CANADA
See also ALBERTA
NEW BRUNSWICK
NEWFOUNDLAND
NOVA SCOTIA
QUEBEC
Coal Mines
Coal reserves in Canada: 1983, 11:10814 (R;CA)
Coal Reserves
Coal reserves in Canada: 1983, 11:10814 (R;CA)
CANCER
See NEOPLASMS
CANINES
See DOGS
CANISTERS
See CONTAINERS
CANONICAL EQUATIONS
See DIFFERENTIAL EQUATIONS
CANONICAL QUANTUM FIELD THEORY
See LAGRANGIAN FIELD THEORY

CAPACITORS
Insulating Oils
Characteristics of insulating oil for electrical applications. Volume 1. Evaluation of insulating oils for use in transformers, capacitors, and cables. Final report, 11:11772 (R;US)
CAPSULES (IRRADIATION)
See IRRADIATION CAPSULES
CAPTURE
Reviews
Radiative reactions in two and three nucleon systems, 11:12288 (R;CA)
CARBAMIDE
See UREA
CARBAZOLES
Raman Spectroscopy
Surface-enhanced Raman spectroscopy: a new tool for chemical detection, 11:11608 (R;US)
CARBIDES
See also IRON CARBIDES
SILICON CARBIDES
TITANIUM CARBIDES
Chemical Vapor Deposition
Fabrication of ceramic-ceramic composites by chemical vapor deposition, 11:11568 (J;US)
CARBINOL
See METHANOL
CARBOHYDRATES
Cross-Linking
Could phytoalexin elicitors operate by a crosslinking mechanism?, 11:11944 (RA;US)
Production
Studies of marine macroalgae: saline desert water cultivation and effects of environmental stress on proximate composition. Final subcontract report (Gracilaria tikvahiae; Ulva lactuca), 11:11170 (R;US)
Pyrolysis
Biomass pyrolysis: a review of the literature. Part 1--carbohydrate pyrolysis, 11:11173 (BA;US)
CARBON
See also ACTIVATED CARBON
CARBON BLACK
DIAMONDS
GRAPHITE
Beryllium 9 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Chemical Reactions
Measurement of the $C_2(a^3PI/sub\ u/)$ and $C_2(X^1\Sigma/sub\ g/^+)$ disappearance rates with O_2 from 298 to 1300 kelvin, 11:11710 (J;US)
Ion Collisions
Excited state populations and charge-exchange of fast ions in solids, 11:12118 (J;NL)
Projectile velocity dependence of the alignment of He-like 2P-states of foil excited S projectiles, 11:12070 (RA;US)
Isotope Ratio
Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)
Lithium 6 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Lithium 7 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Lithium 8 Reactions
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
Mobility
Observation of isolated carbon atoms and the study of their mobility on Pt clusters by NMR, 11:11534 (J;US)
Optical Properties
Investigations of hard, carbon-based surface coatings: from "diamond-like" carbon to silicon carbide. Progress report, July 1, 1985-June 30, 1986 (a-Si/sub 1-x/C/sub x/:H), 11:11579 (R;US)
Pion Minus Reactions
Direct photon production from pions and protons at 200 GeV/c, 11:12295 (R;CH)
Pion Plus Reactions
Direct photon production from pions and protons at 200 GeV/c, 11:12295 (R;CH)
Proton Reactions
Direct photon production from pions and protons at 200 GeV/c, 11:12295 (R;CH)
Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)
CARBON 12
Structure Functions
Multiquark states in nuclei and the deep inelastic scattering, 11:12370 (R;SU)
CARBON 12 REACTIONS
Neutron Emission
Fast neutron emission in interaction of 9 MeV/nucleon ^{12}C and ^{20}Ne ions with ^{181}Ta nuclei, 11:12338 (R;SU;In Russian)
Precompound-Nucleus Emission
Fast neutron emission in interaction of 9 MeV/nucleon ^{12}C and ^{20}Ne ions with ^{181}Ta nuclei, 11:12338 (R;SU;In Russian)
CARBON 12 TARGET
Alpha Reactions
Emission of light fragments ^3H, ^3He and ^4He in ^4He-nucleus collisions at 3.33 GeV/N kinetic energy, 11:12369 (R;SU)
Antiproton Reactions
Antiproton-nucleon physics at LEAR, 11:12284 (R;FR;In French)
Back-angle scattering of antiprotons from nuclei, 11:12301 (R;BR)
Description of antiproton-nucleus scattering with the proton-nucleus Dirac impulse approximation optical potential, 11:12300 (R;BR)
Near/far decomposition of the proton-nucleus and antiproton-nucleus elastic scattering angular distributions, 11:12320 (R;BR)
Carbon 12 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
Neon 20 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
Nitrogen 14 Reactions
Study on particle emission in the light-heavy ion fusion reactions: ^{14}N, sup(16,18) O + ^{12}C, 11:12299 (R;BR)
Oxygen 16 Reactions
Study on particle emission in the light-heavy ion fusion reactions: ^{14}N, sup(16,18) O + ^{12}C, 11:12299 (R;BR)
Oxygen 18 Reactions
Study on particle emission in the light-heavy ion fusion reactions: ^{14}N, sup(16,18) O + ^{12}C, 11:12299 (R;BR)
Use of energy-averaged cross sections for nuclear spectroscopy: ^{36}Mg states in the continuum, 11:12313 (R;BR)
Photonuclear Reactions
Measurement of cross sections of total nuclear photon absorption by the ^{12}C and ^{208}Pb nuclei in the $\Delta(1232)$ region, 11:12294 (R;FR;In French)
CARBON 13
Hyperfine Structure
Ionic dissociation of hydroxycyclohexadienyl radical: effect on ^{13}C hyperfine splittings, 11:11692 (J;US)
CARBON 14 COMPOUNDS
Biosynthesis
Endogenous acceptors for polyuronide biosynthesis in Mucor rouxii, 11:11969 (RA;US)
Model for the mechanism and regulation of chitosan synthesis in Mucor rouxii, 11:11936 (RA;US)
Regulatory mechanisms for the synthesis of β-glucans in plants, 11:11927 (RA;US)
Tracer Techniques
Cellulose synthesis inhibition, cell expansion, and patterns of cell wall deposition in Nitella internodes, 11:11961 (RA;US)
Influence of α sex factor on the biosynthesis of the cell wall from Saccharomyces cerevisiae, 11:11939 (RA;US)
Intracellular localization of hydroxyproline-rich glycoprotein biosynthesis, 11:11930 (RA;US)

Regulation of glycoprotein synthesis in yeast by mating pheromones, 11:11926 (RA;US)
Uptake
Utilization of glucose and UDPG by supprotoplasts of cotton fiber cells, 11:11940 (RA;US)
CARBON BLACK
Gasification
Sodium chloride as a catalyst for the gasification of coal char. Final report, Tasks 8 and 9, 11:10741 (R;US)
CARBON DIOXIDE
Information Systems
Carbon Dioxide Information Center FY 1985 progress report, 11:11867 (R;US)
Mass Transfer
Gas exchange between the forest and the atmosphere, 11:11866 (R;US)
Phase Studies
New high-pressure phase of solid CO_2, 11:11652 (J;US)
Retention
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
Solvent Properties
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985, 11:11142 (R;US)
X-Ray Spectra
Ion-excited K X-ray spectra of oxygen, 11:12076 (RA;US)
CARBON IONS
Ion-Atom Collisions
Electron capture to the continuum from atomic hydrogen, 11:12109 (J;NL)
L-shell X-ray production cross sections in Nd, Gd, Ho, Yb, Au and Pb for 25-MeV carbon and 32-MeV oxygen ions, 11:12110 (J;NL)
M-shell electron capture and direct ionization of gold by 25-MeV carbon and 32-MeV oxygen ions, 11:12111 (J;NL)
Ion-Molecule Collisions
Electron capture to the continuum from atomic hydrogen, 11:12109 (J;NL)
CARBON MONOXIDE
Chemisorption
Effect of potassium on the chemisorption of carbon monoxide on the Rh(111)crystal face, 11:11666 (J;NL)
Hydrogenation
FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report, 11:11130 (R;US)
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)
CARBON OXIDE SULFIDE
See CARBON OXYSULFIDE
CARBON OXYSULFIDE
Dynamics
Exponential separation and long-time correlation in collinear OCS, 11:11664 (J;NL)
Relaxation
Exponential separation and long-time correlation in collinear OCS, 11:11664 (J;NL)
CARBON STEELS
Corrosion
Hydraulics data and materials performance from phase I testing of coal water mixtures, 11:10795 (RA;US)
Erosion
Hydraulics data and materials performance from phase I testing of coal water mixtures, 11:10795 (RA;US)
Welding
Welding of carbon steel vessels without post weld heat treatment, 11:11521 (R;CA)
CARBONYL SULFIDE
See CARBON OXYSULFIDE
CARBONYLATION
Catalysts
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985 (Potassium methoxide), 11:11142 (R;US)
CARBONYLS
Only for compounds of metals with carbonyl radicals.
Adsorption Heat
Metal-support effects on H_2 and CO heats of adsorption on TiO_2-supported platinum, 11:11654 (J;US)
Chemical Preparation
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Molecular Structure
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Photoelectron Spectroscopy
Transition metal-isocyanide bonding: Photoelectron spectroscopic study of iron tetracarbonyl isocyanide complexes, 11:11659 (J;US)
CARBOXYLIC ACIDS
See also MONOCARBOXYLIC ACIDS
Dissociation
Ionic dissociation of hydroxycyclohexadienyl radical: effect on ^{13}C hyperfine splittings, 11:11692 (J;US)
CARCINOGENS
Biological Pathways
Metabolic activation pathways of cyclopenta-fused PAH (polycyclic aromatic hydrocarbons) and their relationship to genetic and carcinogenic activity, 11:11870 (R;US)
Metabolism
Metabolic activation pathways of cyclopenta-fused PAH (polycyclic aromatic hydrocarbons) and their relationship to genetic and carcinogenic activity, 11:11870 (R;US)
CARRIER LIFETIME
Measuring Methods
Birefringence relaxation for semiconductor minority-carrier lifetime measurement. Final report, 11:11848 (R;US)
CARS SPECTROSCOPY
See RAMAN SPECTROSCOPY
CARTELS
Production
Information structures for the control of large scale systems. Final technical report, September 1980-March 1984, 11:11210 (R;US)
CASCADE SHOWERS
Superhigh energy charmed particles penetration in matter, 11:12188 (R;SU)
CASCADE SOLAR CELLS
Fabrication
Stable, high-efficiency, $CuInSe_2$ - based polycrystalline thin-film tandem solar cells. Annual subcontract report, 16 March 1984-15 March 1985, 11:11164 (R;US)
Research Programs
Research on high-efficiency, stacked, multijunction, amorphous silicon alloy thin-film solar cells. A semiannual subcontract progress report, 1 October 1984-15 May 1985, 11:11169 (R;US)
Testing
Stable, high-efficiency, $CuInSe_2$ - based polycrystalline thin-film tandem solar cells. Annual subcontract report, 16 March 1984-15 March 1985, 11:11164 (R;US)
CASCADES (NUCLEAR)
See NUCLEAR CASCADES
CASINGS
See COVERINGS
CATALYSIS
Research Programs
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)

CATALYSTS
Chemical Preparation
Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985, 11:10785 (R;US)
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)
Comparative Evaluations
Two-stage liquefaction catalyst evaluation. Final report (Shell 324M, Amocat IC and Shell S-317), 11:10789 (R;US)
Deactivation
Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)
Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985, 11:10785 (R;US)
PH Value
Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985, 11:10785 (R;US)
Porosity
Two-stage liquefaction catalyst evaluation. Final report (Shell 324M, Amocat IC and Shell S-317), 11:10789 (R;US)
Recovery
Gasification, 11:10736 (RA;US)
Specificity
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)
Sulfidation
Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985, 11:10785 (R;US)
CATAWBA-1 REACTOR
York County, South Carolina, USA
Compliance
Conformance to Regulatory Guide 1.97, Catawba Nuclear Station, Unit Nos. 1 and 2 (Docket Nos. 50-413 and 50-414), 11:11261 (R;US)
CATAWBA-2 REACTOR
York County, South Carolina, USA
Compliance
Conformance to Regulatory Guide 1.97, Catawba Nuclear Station, Unit Nos. 1 and 2 (Docket Nos. 50-413 and 50-414), 11:11261 (R;US)
CATION EXCHANGE CAPACITY
See CATIONS
CATIONS
See also HYDROGEN IONS 1 PLUS
Dissociation
ESR study of the dissociation of hydroxyl protons in hydroxycyclohexadienyl radicals, 11:11691 (J;US)
CAVITY RECEIVERS
Computerized Simulation
Numerical modeling of a solid particle solar central receiver, 11:11178 (R;US)
Particles
Numerical modeling of a solid particle solar central receiver, 11:11178 (R;US)
CDF
Superconducting Magnets
Measurement of the magnetic field of the CDF magnet, 11:11821 (R;US)
CEA GRENOBLE
Research Programs
Progress report 1983. Physica. Vol. 1, 11:12273 (R;FR;In French)
CELL GROWTH (PLANT)
See PLANT CELLS
CELL WALL
Biochemistry
Cell wall proteins extracted from suspension-cultured cells, 11:11931 (RA;US)
Endogenous acceptors for polyuronide biosynthesis in Mucor rouxii, 11:11969 (RA;US)
Pectic fragments of plant cell walls as mediators of stress responses, 11:11934 (RA;US)
Regulatory mechanisms for the synthesis of β-glucans in plants, 11:11927 (RA;US)
Biodegradation
Cell wall breakdown and abscission, 11:11955 (RA;US)
Biological Evolution
Cytokinesis, wall development, and morphogenesis in green algal flagellates, 11:11957 (RA;US)
Kingdoms with walls, 11:11950 (RA;US)
Biological Models
Model for the mechanism and regulation of chitosan synthesis in Mucor rouxii, 11:11936 (RA;US)
Biological Regeneration
Hydroxyproline synthesis is required for cell wall regeneration, 11:11935 (RA;US)
Biosynthesis
Auxin-induced modifications of cell wall polysaccharides in cat coleoptile segments. Effect of galactose, 11:11932 (RA;US)
Control of cell wall assembly during differentiation, 11:11956 (RA;US)
Control of cell wall formation in pollen tubes: the interaction of dictyosome activity with the rate of tip extension, 11:11962 (RA;US)
Influence of α sex factor on the biosynthesis of the cell wall from Saccharomyces cerevisiae, 11:11939 (RA;US)
Chemical Composition
Cell wall development in maize coleoptiles, 11:11958 (RA;US)
Influence of α sex factor on the biosynthesis of the cell wall from Saccharomyces cerevisiae, 11:11939 (RA;US)
KDO (3-deoxy-manno-octulosonic acid), a glycosyl residue thought to occur only in enterobacterial polysaccharides, is also a component of the cell wall of higher plants, 11:11945 (RA;US)
Cytochemistry
Cell wall breakdown and abscission, 11:11955 (RA;US)
Enzymatic Hydrolysis
Depolymerization of matrix polysaccharides by endogenous wall enzymes, 11:11929 (RA;US)
Enzyme Activity
Cell wall proteins extracted from suspension-cultured cells, 11:11931 (RA;US)
Molecular Structure
Chitin and cellulose fibrillogenesis in vivo and their experimental alteration, 11:11954 (RA;US)
Noncellulosic β-glucans in cell walls, 11:11952 (RA;US)
Possible role for hemicelluloses in fruit softening, 11:11941 (RA;US)
Morphological Changes
Regulation of cell wall mechanical properties in vivo and in vitro, 11:11983 (RA;US)
Morphology
Cytokinesis, wall development, and morphogenesis in green algal flagellates, 11:11957 (RA;US)
Glycoprotein component of plant cell walls, 11:11953 (RA;US)
Physiology
Kingdoms with walls, 11:11950 (RA;US)
Structural Chemical Analysis
Why study the structures of biological molecules? The importance of studying the structures of complex carbohydrates, 11:11951 (RA;US)
Xylanase action on alfalfa cell walls, 11:11928 (RA;US)
CELLS (ELECTROLYTIC)
See ELECTROLYTIC CELLS
CELLS (IMMOBILIZED)
See IMMOBILIZED CELLS
CELLS (PLANT)
See PLANT CELLS
CELLULOSE
Biosynthesis
Cellulose synthesis inhibition, cell expansion, and patterns of cell wall deposition in Nitella internodes, 11:11961 (RA;US)
Chitin and cellulose fibrillogenesis in vivo and their experimental alteration, 11:11954 (RA;US)
Fermentation
Recombinant genetic approaches for efficient ethanol production, 11:11145 (BA;US)
Molecular Structure
Polymorphy in native cellulose: recent developments, 11:11968 (RA;US)

Nuclear Magnetic Resonance
Polymorphy in native cellulose: recent developments, 11:11968 (RA;US)

CENTRIFUGE ENRICHMENT PLANTS
See also PORTSMOUTH CENTRIFUGE ENRICHMENT PLANT
Nuclear Materials Management
Results from the study of UF_6 consumption on centrifuge process piping and its influence on gamma ray measurements, 11:10982 (J;US)

CERAMIC MELTERS
Process Control
Instrumentation for remote monitoring and control of liquid-fed ceramic melters, 11:11028 (R;US)
Remote Control
Instrumentation for remote monitoring and control of liquid-fed ceramic melters, 11:11028 (R;US)

CERAMICS
Annealing
Grain growth in three dimensions: a lattice model, 11:11546 (J;US)
Bending
Damage analysis of creep in bending, 11:11561 (J;US)
Chemical Reaction Kinetics
Silicon nitride joining, 11:11560 (J;US)
Chemical Vapor Deposition
Fabrication of ceramic-ceramic composites by chemical vapor deposition, 11:11568 (J;US)
Creep
Damage analysis of creep in bending, 11:11561 (J;US)
Crystal Lattices
Grain growth in three dimensions: a lattice model, 11:11546 (J;US)
Fracture Properties
Multiaxial stress response of ceramics. Progress report, December 1, 1984-November 30, 1985, 11:11553 (R;US)
Grain Growth
Grain growth in three dimensions: a lattice model, 11:11546 (J;US)
Joining
Silicon nitride joining, 11:11560 (J;US)
Microstructure
Damage analysis of creep in bending, 11:11561 (J;US)
Stability
Encapsulation of spent nuclear fuel in ceramic materials. An introductory study, 11:11024 (R;SE)
Stress Analysis
Damage analysis of creep in bending, 11:11561 (J;US)

CERCARIA
See PLATYHELMINTHS

CERIUM
Catalytic Effects
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)

CERIUM 144
Soil Chemistry
Ground disposal of radioactive wastes at the Hanford site, 11:11901 (R;US)

CERIUM COMPOUNDS
See also CERIUM OXIDES
CERIUM PHOSPHATES
Oxidation
Redox reactivity of transition-metal phthalocyanines: ligand radical formation vs. metal center oxidation, 11:11682 (J;US)

CERIUM OXIDES
Chemical Properties
Ion exchange characteristics of hydrous oxides and their use in the separation of uranium and thorium, 11:11612 (RA;XA)

CERIUM PHOSPHATES
Chemical Radiation Effects
Effect of gamma radiation on various inorganic ion exchangers, 11:11712 (RA;XA)

CESIUM
Boiling Points
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Critical Pressure
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Critical Temperature
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Desorption
Silicon (111) and (100) surfaces and their interactions with Sc, K, Na and Li; phase changes and kinetics of desorption studied by surface ionization, 11:11667 (J;NL)
Ion Exchange Chromatography
Separation and purification of fission products from process streams of irradiated nuclear fuel, 11:11022 (RA;XA)
Melting Points
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)

CESIUM 134
Biological Accumulation
Assimilation and biological turnover of cesium-134, iodine-131, and chromium-51 in brown crickets, Acheta domesticus (L.), 11:12013 (J;US)

CESIUM 137
Diffusion
Investigation of siting parameters for near surface disposal of low-level nuclear waste. Final report, 11:11000 (R;US)
Translocation
Comparison of predictions from internationally recognized assessment models for the transfer of selected radionuclides through terrestrial food chains, 11:11904 (J;US)

CHARCOAL
Surface Cleaning
Elution of benzene and methyl ethyl ketone from charcoal beds by continued air sweeping. Interim report, March 1983-November 1984, 11:11782 (R;US)

CHARGE CONSERVATION
Symmetry Breaking
Few-body strange systems, 11:12372 (R;US)

CHARGE EXCHANGE
Meetings
Proceedings of the LAMPF workshop on pion double charge exchange, 11:12281 (R;US)

CHARGED-PARTICLE ACTIVATION
See ACTIVATION ANALYSIS

CHARMED MESON RESONANCES
Particle Production
Superhigh energy charmed particles penetration in matter, 11:12188 (R;SU)

CHARS
Combustion
Effect of in-situ heat treatment on coal char reactivity. Engineering kinetics of coal pyrolysis and combustion in normal and high intensity flames. Progress report, 11:10908 (R;US)
Gasification
Sodium chloride as a catalyst for the gasification of coal char. Final report, Tasks 8 and 9, 11:10741 (R;US)
Heat Treatments
Effect of in-situ heat treatment on coal char reactivity. Engineering kinetics of coal pyrolysis and combustion in normal and high intensity flames. Progress report, 11:10908 (R;US)

CHATTANOOGA FORMATION
Extraction of Green River and Chattanooga oil shales with strong bases and nucleophilic displacement reagents, 11:10967 (R;US)

CHELATES
Chemical Composition
Tin-117M-labeled stannic (SN^{4+}) chelates, 11:11982 (P;US)
Chemical Preparation
Tin-117M-labeled stannic (SN^{4+}) chelates, 11:11982 (P;US)

CHEMICAL ANALYSIS
See also ACTIVATION ANALYSIS
NONDESTRUCTIVE ANALYSIS
NUCLEAR REACTION ANALYSIS
Data Processing
Coping with the information explosion provided by modern chemical instrumentation, 11:12527 (J;US)

Recommendations
Sodium in low-rank coal, 11:10797 (R;US)
CHEMICAL EFFLUENTS
Organohalogens in chlorinated cooling waters discharged from nuclear power stations, 11:11255 (R;US)
Monitoring
Guidance document for prioritizing supplemental monitoring around synfuels facilities, 11:10922 (R;US)
CHEMICAL EXPLOSIVES
See also NITROMETHANE
Chemical Analysis
Chemistry of (5-cyanotetrazolato-N²)pentaamminecobalt(III) perchlorate and similar explosive coordination compounds, 11:11851 (J;US)
Chemical Composition
Chemistry of (5-cyanotetrazolato-N²)pentaamminecobalt(III) perchlorate and similar explosive coordination compounds, 11:11851 (J;US)
Combustion Properties
Chemistry of (5-cyanotetrazolato-N²)pentaamminecobalt(III) perchlorate and similar explosive coordination compounds, 11:11851 (J;US)
Research Programs
Fundamental research on explosives program, 11:11850 (J;US)
Thermal Degradation
Chemistry of (5-cyanotetrazolato-N²)pentaamminecobalt(III) perchlorate and similar explosive coordination compounds, 11:11851 (J;US)
Thermodynamic Properties
Chemistry of (5-cyanotetrazolato-N²)pentaamminecobalt(III) perchlorate and similar explosive coordination compounds, 11:11851 (J;US)
CHEMICAL INDUSTRY
Fuel Cells
Potential application of fuel cells in the chlor-alkali industry, 11:11410 (R;US)
CHEMICAL PROPERTIES
Data Processing
Coping with the information explosion provided by modern chemical instrumentation, 11:12527 (J;US)
CHEMICAL REACTIONS
See also CARBONYLATION
CORROSION
DENITRIFICATION
DESULFURIZATION
FISCHER-TROPSCH SYNTHESIS
HYDROGENATION
METHANATION
Nuclear Screening
Nuclear-motion corrections to Born-Oppenheimer barrier heights for chemical reactions, 11:11640 (R;US)
CHEMICALS
See ADDITIVES
CARCINOGENS
REAGENTS
SURFACTANTS
CHERENKOV COUNTERS
Beam Optics
Design of the optical components and gas control systems of the CERN Omega Ring Imaging Cerenkov Detector, 11:11837 (R;GB)
Design
IMB detector - the first 30 days, 11:11843 (J;US)
Performance
IMB detector - the first 30 days, 11:11843 (J;US)
Specifications
Facility for studying the cross sections of relativistic nuclear fragment strong interactions at the Dubna synchrophasotron, 11:11833 (RA;SU;In Russian)
CHERENKOV DETECTORS
See CHERENKOV COUNTERS
CHESAPEAKE BAY
Plankton
Upper bay network: a study of the plankton resources of the upper Chesapeake Bay. Volume 1, text. Volume 2, Appendices a-o. Final report 1982-1983, 11:11909 (R;US)
CHI-3550 RESONANCES
Hadronic Particle Decay
Exclusive decays of heavy mesons into baryons, 11:12215 (J;NL)
CHINA
Reference Man
Preliminary radiation protection tests for the body height and body weight of the Chinese reference man, 11:12394 (TG;US)
Research Programs
Advance of SSCT's CWF project in China (State Science and Technology Commission; coal water fuel), 11:10833 (RA;US)
CHITIN
Biosynthesis
Chitin and cellulose fibrillogenesis in vivo and their experimental alteration, 11:11954 (RA;US)
Sterol composition of chitosomes from Mucor rouxii, comparison with whole cells, 11:11942 (RA;US)
CHLOR-ALKALI INDUSTRY
See CHEMICAL INDUSTRY
CHLORINE
CHLORINATED ALIPHATIC HYDROCARBONS
Chemical Reactions
Gas-phase reactions of atomic chlorine with vinyl chloride, 11:11685 (J;US)
Desorption
Sorption and desorption of volatile chlorinated aliphatic compounds by soils and soil components. Doctoral theses, 11:11914 (R;US)
Excitation
Composite sequences for efficient double-quantum excitation over a range of spin coupling strengths, 11:12124 (J;GB)
Performance
Chlorinated solvents for coal beneficiating, 11:10829 (RA;US)
Sorption
Sorption and desorption of volatile chlorinated aliphatic compounds by soils and soil components. Doctoral theses, 11:11914 (R;US)
CHLORINE
Atom-Molecule Collisions
Variational-transition-state theory with least-action tunneling calculations for the kinetic isotope effects in the $Cl+h_2$ reaction: tests of extended-leps, information-theoretic, and diatomics-in-molecules potential energy surfaces, 11:12062 (R;US)
Chemical Reactions
Gas-phase reactions of atomic chlorine with vinyl chloride, 11:11685 (J;US)
X-Ray Spectra
Systematics of K X-ray satellite structure excited by heavy-ion impact, 11:12075 (RA;US)
CHLORINE CHLORIDES
See CHLORINE
CHLORINE IONS
Collisions
Excited state populations and charge-exchange of fast ions in solids, 11:12118 (J;NL)
Ultrahigh-resolution studies of heavy-ion induced X-ray satellite emission, 11:12114 (J;NL)
Electron-Ion Collisions
Electron collisions with positive ions. Progress report, April 1, 1985-March 31, 1986, 11:12079 (R;US)
Ion-Atom Collisions
Investigations of molecular orbitals with accel-decel beams, 11:12104 (J;NL)
CHLOROPHYLL
Chlorophyll a concentration and distribution in Twin Lakes, Colorado prior to operation of Mt. Elbert Pumped-Storage Powerplant, 1977-1981. Technical report, 11:11154 (R;US)
Absorption Spectroscopy
Electron spin resonance study of chlorophyll a cation radical in photoirradiated frozen vesicle solutions with or without electron scavengers, 11:11703 (J;US)
Electron Spin Resonance
Electron spin resonance study of chlorophyll a cation radical in photoirradiated frozen vesicle solutions with or without electron scavengers, 11:11703 (J;US)

Fluorescence
Effects of molecular organization on photophysical behavior: lifetime and steady-state fluorescence of chlorophyll a singlets in monolayers of dioleoylphosphatidylcholine at the nitrogen-water interface, 11:11687 (J;US)
Effects of cation-induced and pH-induced membrane stacking on chlorophyll fluorescence decay kinetics, 11:11695 (J;NL)
Photochemical Reactions
Electron spin resonance study of chlorophyll a cation radical in photoirradiated frozen vesicle solutions with or without electron scavengers, 11:11703 (J;US)

CHLOROPLASTS
Electron Transfer
Effects of chloride depletion on electron donation from the water-oxidizing complex to the photosystem II reaction center as measured by the microsecond rise of chlorophyll fluorescence in isolated pea chloroplasts, 11:11174 (J;NL)

CHORDATES
See VERTEBRATES

CHROMATID DELETIONS
See CHROMOSOMAL ABERRATIONS

CHROMIC ACID
Molecular Structure
Inelastic neutron scattering spectrum of chromous acid at high energy transfers, 11:11656 (J;US)

CHROMIUM
Catalytic Effects
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985, 11:11142 (R;US)

CHROMIUM 51
Biological Accumulation
Assimilation and biological turnover of cesium-134, iodine-131, and chromium-51 in brown crickets, Acheta domesticus (L.), 11:12013 (J;US)
Diffusion
Influence of anisotropy and doping on grain boundary diffusion in oxide systems, 11:11566 (J;NL)

CHROMIUM ALLOYS
See also STAINLESS STEELS
Creep
Creep-rupture behavior of iron superalloys in high-pressure hydrogen, 11:11516 (R;US)

CHROMIUM COMPOUNDS
See also CHROMIC ACID
CHROMIUM PHOSPHATES
Precipitation
Precipitate formation in austenitic stainless steel welds, 11:11545 (J;US)

CHROMIUM IONS
X-Ray Spectra
Spectroscopy of Ldagger-series transitions for x-ray laser photopumping, 11:11760 (J;US)

CHROMIUM PHOSPHATES
Chemical Radiation Effects
Effect of gamma radiation on various inorganic ion exchangers, 11:11712 (RA;XA)

CHROMIUM-MOLYBDENUM STEELS
Tensile Properties
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1985, 11:10790 (R;US)

CHROMODYNAMICS
See QUANTUM CHROMODYNAMICS

CHROMOSOMAL ABERRATIONS
Radioinduction
Chromosome investigations on persons whose mothers have been treated with ionizing radiations during pregnancy, 11:11995 (R;DE;In German)

CHROMOSOME ABERRATIONS
See CHROMOSOMAL ABERRATIONS

CHROMOSOME EXCHANGES
See CHROMOSOMAL ABERRATIONS

CHROMOSOME FRAGMENTS
See CHROMOSOMAL ABERRATIONS

CHROMOSOMES
Light Scattering
Circular intensity differential scattering of light by hierarchical molecular structures, 11:11948 (J;US)

CIRCUITS (ELECTRONIC)
See ELECTRONIC CIRCUITS

CISTRONS
See GENES

CLATHRATES
Mass Spectroscopy
Comment on "High-resolution scanning-ion-microprobe study of graphite and its intercalation compounds", 11:11592 (J;US)
Morphology
Comment on "High-resolution scanning-ion-microprobe study of graphite and its intercalation compounds", 11:11592 (J;US)

CLAYS
See also BENTONITE
Radiation Effects
Observations regarding the stability of bentonite backfill in a high-level waste (HLW) repository in rock salt, 11:11585 (R;US)

CLIFFORD ALGEBRA
Supersymmetry
Superspace in the Dirac-Kaehler framework in two dimensions, 11:12233 (R;BR)

CLIMATE MODELS
Global low order spectral model designed for climate sensitivity studies, 11:11862 (R;US)
Validation
Model validation research: comparison of simulated and observed climate patterns for the past 18,000 years. Progress report, February 1, 1985-January 31, 1986, 11:11858 (R;US)

CLIMATES
Data Processing
Climatological data for site selection and planning, 11:11880 (BA;US)
Forecasting
General circulation variability, medium to long-range forecasting, and energy industry related applications. Final report, 1 January 1983-31 December 1985, 11:11861 (R;US)
Simulation
Global low order spectral model designed for climate sensitivity studies, 11:11862 (R;US)
Model validation research: comparison of simulated and observed climate patterns for the past 18,000 years. Progress report, February 1, 1985-January 31, 1986, 11:11858 (R;US)
Temperature Effects
Associations between summer circulation anomalies and sea surface temperature forcing, 11:11863 (R;US)

CLUSTER MODEL
Baryons
Study of light baryons in the three quark cluster model: exact calculations, 11:12195 (R;FR)

CLUSTERS (FUEL ELEMENTS)
See FUEL ELEMENT CLUSTERS

CLUSTERS (SOLID)
See SOLID CLUSTERS

COAL
See also SUBBITUMINOUS COAL
Activation Analysis
Investigation of trace elements in domestic coal and its combustion products, as well as in industrial samples and ashes of special refuse by means of neutron activation analysis, 11:10801 (R;AT;In German)
Agglomeration
Approach to deashing of some Chinese coals by oil-agglomeration method, 11:10830 (RA;US)
Ash Content
Evaluation of the effect of coal cleaning on fugitive elements. Phase IV. Identification of mineral forms in coal. Quarterly progress report No. 10, September 1-November 30, 1985, 11:10825 (R;US)
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, January-March 1985, 11:10854 (R;US)
Ashes
Viscosity of low-rank coal slags, 11:10904 (RA;US)

Chemical Composition
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, January-March 1985, 11:10854 (R;US)
Sodium in low-rank coal, 11:10797 (R;US)
Chemical Reaction Kinetics
Development of a bench-scale fluidized bed combustor for coal reactivity studies, 11:10913 (R;CA)
Cleaning
Evaluation of the effect of coal cleaning on fugitive elements. Phase IV. Identification of mineral forms in coal. Quarterly progress report No. 10, September 1-November 30, 1985, 11:10825 (R;US)
Combustion
Combustion and pollutant-forming characteristics of low-rank western coals, 11:10899 (RA;US)
Conventional combustion, 11:10898 (RA;US)
Detailed model for practical pulverized coal furnaces and gasifiers. Quarterly technical progress report No. 2, August 1-October 31, 1985, 11:10910 (R;US)
Effect of in-situ heat treatment on coal char reactivity. Ostwald equations and combustion efficiency in hydrocarbon and coal flames. Progress report, 11:10909 (R;US)
Effect of in-situ heat treatment on coal char reactivity. Engineering kinetics of coal pyrolysis and combustion in normal and high intensity flames. Progress report, 11:10908 (R;US)
Fundamentals of coal dust combustion: recommendations for research on explosive limits of coal dust, 11:10897 (RA;US)
Modelling of heat transfer and furnace conditions in pulverised coal fired boilers, 11:11214 (RA;US)
On-line measurements of fouling and slagging (full-scale and pilot units) and correlation with predictive indices in conventionally fired steam generators, 11:11212 (RA;US)
Predicting and assessing tube metal wastage in boilers fired with low-rank coal, 11:11213 (RA;US)
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Combustion Kinetics
Comparative combustion studies of ultrafine coal/water slurries and pulverized coal, 11:10870 (RA;US)
Combustion Products
Potential resources from coal fly ash, 11:10806 (J;US)
Combustion Properties
Experimental study of coal ash catalyzed reactions between carbon monoxide and hydrogen, 11:10759 (RA;US)
Comminution
Coal beneficiation by expansion of a supercritical coal/water slurry, 11:10828 (RA;US)
Use of high pressure water jets as a high efficiency tool for coal comminution, 11:10832 (RA;US)
Compression Strength
Strength and deformation properties of various rocks from the Springhill coal mine, Nova Scotia, 11:10821 (R;CA)
Consumption Rates
Model of the use of coal, gas, and oil (Brookhaven Energy System Optimization Model (BESOM)), 11:11398 (J;GB)
Deashing
Approach to deashing of some Chinese coals by oil-agglomeration method, 11:10830 (RA;US)
Coal beneficiation by expansion of a supercritical coal/water slurry, 11:10828 (RA;US)
Energy efficiency comparison of coal slurry transportation systems, 11:10847 (RA;US)
Flexible approach to expanding production capacity for Nycol, 11:10842 (RA;US)
Desulfurization
Flexible approach to expanding production capacity for Nycol, 11:10842 (RA;US)
Devolatilization
Combustion of calcium-exchanged coal. Eighth quarterly report, 11:10905 (R;US)
Energy Source Development
Industry's role in exporting UCG technology, 11:11397 (RA;US)
Exports
Coal distribution, January-September 1985 (USA; production by coal producing districts), 11:10815 (R;US)
Flotation
Advanced physical fine coal cleaning microbubble flotation. Topical report No. 1. GHH-Bergbau Forschung microbubble coal flotation machine, 11:10857 (R;US)
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, January-March 1985, 11:10854 (R;US)
Fluidized-Bed Combustion
Development of a bench-scale fluidized bed combustor for coal reactivity studies, 11:10913 (R;CA)
Fluid bed combustion bed properties with LRC, 11:10902 (RA;US)
Fluidized bed combustion, 11:10900 (RA;US)
Fracture Mechanics
Use of high pressure water jets as a high efficiency tool for coal comminution, 11:10832 (RA;US)
Fuel Substitution
Use of coal-water fuels in a contemporary steam locomotive, 11:10884 (RA;US)
Hydraulic Transport
Energy efficiency comparison of coal slurry transportation systems, 11:10847 (RA;US)
Western Resource Transport project: a liquid carbon dioxide/coal slurry pipeline, 11:10850 (RA;US)
Hydrogenation
Gasification, 11:10736 (RA;US)
Inventories
Coal distribution, January-September 1985 (USA; production by coal producing districts), 11:10815 (R;US)
Ion Exchange
Combustion of calcium-exchanged coal. Eighth quarterly report, 11:10905 (R;US)
Macerals
Laser induced coal fluorescence. Twelfth quarterly technical progress report, July 1-September 31, 1985, 11:10798 (R;US)
Market
Coal distribution, January-September 1985 (USA; production by coal producing districts), 11:10815 (R;US)
Mechanical Properties
What can be learned from linking tests at great depth?, 11:10775 (RA;US)
Multi-Element Analysis
Investigation of trace elements in domestic coal and its combustion products, as well as in industrial samples and ashes of special refuse by means of neutron activation analysis, 11:10801 (R;AT;In German)
Pneumatic Transport
Pneumatic transport of coal in a variable inclined test loop. Quarterly report 2 (Evaluation of cocurrent upflow and downflow of solid-gas mixtures in inclined pipelines), 11:10858 (R;US)
Pressure Effects
What can be learned from linking tests at great depth?, 11:10775 (RA;US)
Production
Alberta's coal industry - annual statistics at 31 December 1984, 11:10917 (R;CA)
Coal distribution, January-September 1985 (USA; production by coal producing districts), 11:10815 (R;US)
Coal reserves in Canada: 1983, 11:10814 (R;CA)
Weekly coal production, January 4, 1986 (By state), 11:10816 (R;US)
Pyrolysis
Effect of in-situ heat treatment on coal char reactivity. Engineering kinetics of coal pyrolysis and combustion in normal and high intensity flames. Progress report, 11:10908 (R;US)
Gasification, 11:10736 (RA;US)
Rail Transport
Delivering coal without the dust and noise, 11:10848 (RA;US)

Sulfur Content
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, January-March 1985, 11:10854 (R;US)
Tensile Properties
Coal strength parameters derived for the No. 1 (Scott Pitt) seam, Drummond mine, Westville, NS, 11:10800 (R;CA)
Transport
Coal distribution, January-September 1985 (USA; production by coal producing districts), 11:10815 (R;US)
Washing
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, January-March 1985, 11:10854 (R;US)
Water Removal
Energy efficiency comparison of coal slurry transportation systems, 11:10847 (RA;US)

COAL CHEMICALS
See COAL EXTRACTS

COAL DEPOSITS
See also COAL SEAMS
Economic Analysis
Factors affecting the rent to surface-mined coal tracts in the Powder River Basin and Green River/Hams Fork Region, 11:10918 (R;US)
Exploration
Alberta's coal industry - annual statistics at 31 December 1984, 11:10917 (R;CA)
Fracture Mechanics
Use of post-burn coring data from the Hanna III field test to infer the spalling characteristics, water influx and heat losses, 11:10770 (RA;US)
Leasing
Factors affecting the rent to surface-mined coal tracts in the Powder River Basin and Green River/Hams Fork Region, 11:10918 (R;US)
Rock Mechanics
Use of post-burn coring data from the Hanna III field test to infer the spalling characteristics, water influx and heat losses, 11:10770 (RA;US)
Royalties
Factors affecting the rent to surface-mined coal tracts in the Powder River Basin and Green River/Hams Fork Region, 11:10918 (R;US)

COAL EXTRACTS
Mutagen Screening
Exploratory research on mutagenic activity of coal-related materials using statistical evaluation, 11:10921 (R;US)

COAL FINES
Ash Content
Froth flotation for fine-coal cleaning. Final report, 11:10860 (R;US)
Flotation
Froth flotation for fine-coal cleaning. Final report, 11:10860 (R;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Grinding
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Particle Size
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, July-September 1985, 11:10855 (R;US)
Sulfur Content
Froth flotation for fine-coal cleaning. Final report, 11:10860 (R;US)

COAL GASIFICATION
See also BABCOCK AND WILCOX-DUPONT PROCESS
EXXON GASIFICATION PROCESS
HYGAS PROCESS
KOPPERS-TOTZEK PROCESS
LURGI PROCESS
TEXACO GASIFICATION PROCESS
By-Products
Gasification, 11:10736 (RA;US)
Catalysts
Gasification, 11:10736 (RA;US)
Sodium chloride as a catalyst for the gasification of coal char. Final report, Tasks 8 and 9, 11:10741 (R;US)
Computerized Simulation
Dynamic simulation of entrained coal gasification, 11:10742 (R;US)
Condensates
Gasification, 11:10736 (RA;US)
Mathematical Models
Detailed model for practical pulverized coal furnaces and gasifiers. Quarterly technical progress report No. 2, August 1-October 31, 1985, 11:10910 (R;US)
Meetings
Preparation, handling, and storage, 11:10851 (RA;US)
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Research Programs
Gasification, 11:10736 (RA;US)
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Status of the joint Belgo-German experiment of underground coal gasification, 11:10745 (RA;US)
Solid Wastes
Gasification, 11:10736 (RA;US)
Technology Assessment
Panama coal to methanol project. Phase I. Feasibility Study. Technical progress report, 11:11140 (R;US)
Waste Water
Gasification, 11:10736 (RA;US)

COAL GASIFICATION PLANTS
Evaluation
Surface gasification data system: feasibility studies overview report, 11:10778 (R;US)
Feasibility Studies
Surface gasification data system: feasibility studies overview report, 11:10778 (R;US)
Materials Testing
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1985, 11:10790 (R;US)
Waste Water
Research on wastewater treatment and reuse for coal gasification and liquefaction, 11:10738 (RA;US)

COAL LIQUEFACTION
See also COSTEAM PROCESS
EXXON LIQUEFACTION PROCESS
H-COAL PROCESS
LIQUID PHASE METHANOL PROCESS
SRC-II PROCESS
TSL PROCESS
Catalysts
Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985, 11:10785 (R;US)
Liquefaction, 11:10739 (RA;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Chemical Effluents
Comparative biology and chemistry of boiling point fractions from different coal liquefaction processes, 11:10927 (R;US)
Meetings
Liquefaction, 11:10739 (RA;US)
Preparation, handling, and storage, 11:10851 (RA;US)
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Organic Solvents
Determination of radical initiating and hydrogen donating properties of coal liquefaction process solvents by reaction with fluorenone, 11:10792 (R;US)
Enhanced coal liquefaction with ammonia and amines in single and binary solvent systems. Seventh quarterly report, April 1-June 30, 1985, 11:10780 (R;US)
Liquefaction, 11:10739 (RA;US)

Research Programs
Direct coal liquefaction using iron-titanium hydride as a hydrogen distribution and catalytic material. Progress report No. 5, September 1-November 30, 1985, 11:10786 (R;US)
Liquefaction, 11:10739 (RA;US)
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Residues
Liquefaction, 11:10739 (RA;US)
Yields
Direct coal liquefaction using iron-titanium hydride as a hydrogen distribution and catalytic material. Progress report No. 5, September 1-November 30, 1985, 11:10786 (R;US)

COAL LIQUEFACTION PLANTS
Waste Water
Research on wastewater treatment and reuse for coal gasification and liquefaction, 11:10738 (RA;US)

COAL LIQUIDS
Boiling Points
Coal conversion (liquefaction/gasification): engineering considerations and relationships among physical, chemical and toxicological properties of resulting materials, 11:10793 (R;US)
Carcinogen Screening
EDS Coal Liquefaction Process Development. Phase V. Quarterly technical progress report, July 1-September 30, 1985, 11:10920 (R;US)
Carcinogens
Coal conversion (liquefaction/gasification): engineering considerations and relationships among physical, chemical and toxicological properties of resulting materials, 11:10793 (R;US)
Chemical Composition
Coal liquefaction process solvent characterization and evaluation. Topical progress report, July 1, 1985-September 30, 1985, 11:10783 (R;US)
Chemical Properties
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Deashing
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Fractionation
Coal conversion (liquefaction/gasification): engineering considerations and relationships among physical, chemical and toxicological properties of resulting materials, 11:10793 (R;US)
Coal liquefaction process solvent characterization and evaluation. Topical progress report, July 1, 1985-September 30, 1985, 11:10783 (R;US)
Methodologies for the separation of chemical classes from coal liquefaction materials, 11:10928 (R;US)
Hydrogenation
Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Information
Coal conversion (liquefaction/gasification): engineering considerations and relationships among physical, chemical and toxicological properties of resulting materials, 11:10793 (R;US)
Mutagen Screening
Coal conversion (liquefaction/gasification): engineering considerations and relationships among physical, chemical and toxicological properties of resulting materials, 11:10793 (R;US)
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Physical Properties
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Refining
Liquefaction, 11:10739 (RA;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Solvent Extraction
Exploratory research on mutagenic activity of coal-related materials using statistical evaluation, 11:10921 (R;US)
Thermal Conductivity
Thermal conductivities of Wilsonville solvent and Wilsonville solvent/Illinois No. 6 coal slurry, 11:10791 (R;US)
Toxicity
Coal conversion (liquefaction/gasification): engineering considerations and relationships among physical, chemical and toxicological properties of resulting materials, 11:10793 (R;US)
EDS Coal Liquefaction Process Development. Phase V. Quarterly technical progress report, July 1-September 30, 1985, 11:10920 (R;US)
Yields
Direct coal liquefaction using iron-titanium hydride as a hydrogen distribution and catalytic material. Progress report No. 5, September 1-November 30, 1985, 11:10786 (R;US)

COAL MINES
Acid Mine Drainage
Control of acid mine drainage. Proceedings of a technology-transfer seminar. Information circular/1985, 11:10811 (R;US)
Ground Water
Design of bulkheads for controlling water in underground mines. Information Circular/1985, 11:10824 (R;US)
Longwall Mining
Demonstration of shield-type longwall supports at Kaiser Steel Corporation's No. 1 mine, Utah. Open File report February 1980-April 1982, 11:10926 (R;US)
Regulations
Rollover protective structures (ROPS) inspection and maintenance guide. Information circular/1985, 11:10923 (R;US)
Safety
Rollover protective structures (ROPS) inspection and maintenance guide. Information circular/1985, 11:10923 (R;US)

COAL MINING
Economics
Peat - a viable alternative for energy production, 11:10813 (RA;PR)
Land Reclamation
First observations of ecological surveillance plots on afforested open-cast spoil in South Wales. Occasional paper, 11:10810 (R;GB)
Longwall Mining
Remedial and stratareplacement techniques on longwall faces. Report on the state of the art. Information Circular/1985, 11:10823 (R;US)
Mining Equipment
Research oriented technological needs in the Sydney coalfield, 11:10818 (R;CA)
Research Programs
Research oriented technological needs in the Sydney coalfield, 11:10818 (R;CA)
Technology Assessment
Peat - a viable alternative for energy production, 11:10813 (RA;PR)

COAL PREPARATION
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Bibliographies
Annotated bibliography of US government coal preparation publications, 1910-1984, 11:10859 (R;US)
Comparative Evaluations
Energy efficiency comparison of coal slurry transportation systems, 11:10847 (RA;US)
Economic Analysis
Coal beneficiation by expansion of a supercritical coal/water slurry, 11:10828 (RA;US)
Economics
Chlorinated solvents for coal beneficiating, 11:10829 (RA;US)

Conventional coal cleaning of high-ash low-rank coals, 11:10852 (RA;US)
Energy Efficiency
Energy efficiency comparison of coal slurry transportation systems, 11:10847 (RA;US)
Meetings
Preparation, handling, and storage, 11:10851 (RA;US)
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Research Programs
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Technology Assessment
Coal beneficiation by expansion of a supercritical coal/water slurry, 11:10828 (RA;US)
COAL PREPARATION PLANTS
Capacity
Flexible approach to expanding production capacity for Nycol, 11:10842 (RA;US)
Capitalized Cost
Capital and operating costs for commercial scale coal-water slurry preparation plants, 11:10914 (RA;US)
Design
Progress in the design of coal-water fuel plants, 11:10836 (RA;US)
Economic Analysis
Coal slurry production costs, 11:10915 (RA;US)
Equipment
Conventional coal cleaning of high-ash low-rank coals, 11:10852 (RA;US)
Mixers
Use of intensive mixing in the preparation of CWS, 11:10846 (RA;US)
Operating Cost
Capital and operating costs for commercial scale coal-water slurry preparation plants, 11:10914 (RA;US)
Performance Testing
Preparation test of HCWS at a pilot plant in 1984 (Highly-loaded coal water slurry), 11:10838 (RA;US)
COAL SEAMS
Carbonization
Modeling and experimental studies of electrolinking, 11:10764 (RA;US)
Combustion Kinetics
Oxidation kinetics and models for self ignition of coal in underground gasification, 11:10768 (RA;US)
Combustion Properties
Modeling of 2-D cavity growth using continuously deforming finite elements, 11:10774 (RA;US)
Crack Propagation
Analysis of early cavity growth in underground coal gasification, 11:10767 (RA;US)
Electric Conductivity
Modeling and experimental studies of electrolinking, 11:10764 (RA;US)
Fracture Mechanics
Analysis of early cavity growth in underground coal gasification, 11:10767 (RA;US)
Parametric study of a simplified model of coal face spalling, 11:10771 (RA;US)
Fracturing
Influence of H_2O at high PT-conditions upon the volumetric and mobility behavior of bituminous coal for in-situ-gasification after linking-process, 11:10761 (RA;US)
Mechanical Properties
Modeling of 2-D cavity growth using continuously deforming finite elements, 11:10774 (RA;US)
Rock Mechanics
Parametric study of a simplified model of coal face spalling, 11:10771 (RA;US)
Preliminary results of postburn coring and drilling at WIDCo-CRIP UCG experimental test site, Centralia, Washington, 11:10749 (RA;US)
Spontaneous Combustion
Oxidation kinetics and models for self ignition of coal in underground gasification, 11:10768 (RA;US)
Strata Movement
Preliminary results of postburn coring and drilling at WIDCo-CRIP UCG experimental test site, Centralia, Washington, 11:10749 (RA;US)
Swelling
Influence of H_2O at high PT-conditions upon the volumetric and mobility behavior of bituminous coal for in-situ-gasification after linking-process, 11:10761 (RA;US)
Temperature Effects
Preliminary results of postburn coring and drilling at WIDCo-CRIP UCG experimental test site, Centralia, Washington, 11:10749 (RA;US)
Thermal Conductivity
Parametric study of a simplified model of coal face spalling, 11:10771 (RA;US)
Thermal Expansion
Influence of H_2O at high PT-conditions upon the volumetric and mobility behavior of bituminous coal for in-situ-gasification after linking-process, 11:10761 (RA;US)
COAL TAR
Chemical Reaction Yield
Kinetics of coal pyrolysis and devolatilization. Technical progress report, August 1, 1985-October 31, 1985, 11:10784 (R;US)
Molecular Weight
Kinetics of coal pyrolysis and devolatilization. Technical progress report, August 1, 1985-October 31, 1985, 11:10784 (R;US)
COAL-DERIVED LIQUIDS
See COAL LIQUIDS
COAL-OIL MIXTURES
See COAL
FUEL OILS
FUEL SLURRIES
COALTEK PROCESS
See FUEL FEEDING SYSTEMS
COASTAL WATERS
Air-Water Interactions
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, 1 Dec 1984-30 November 1985, 11:11905 (R;US)
Fishes
Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic). Mummichog and striped killifish, 11:11911 (R;US)
Mineral Cycling
Coordination: Southeast continental shelf studies. Progress report, 1 June 1984-31 December 1985, 11:12034 (R;US)
Sediments
Trace element geochemistry of the South Atlantic Bight. Progress report, 11:11907 (R;US)
Shrimp
Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico). Grass shrimp, 11:11910 (R;US)
COATINGS
See also PROTECTIVE COATINGS
Optical Properties
Investigations of hard, carbon-based surface coatings: from "diamond-like" carbon to silicon carbide. Progress report, July 1, 1985-June 30, 1986 (a-Si/sub 1-x/C/sub x/:H), 11:11579 (R;US)
Production
Formation of surface layers of icosahedral Al(Mn), 11:11528 (R;US)
COBALT
Catalytic Effects
Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)
Chemical Bonds
Some considerations about bond indices in non-orthogonal bases and the MO calculation of valence and oxidation number, 11:11641 (R;BR)
Valence
Some considerations about bond indices in non-orthogonal bases and the MO calculation of valence and oxidation number, 11:11641 (R;BR)

COBALT 57
Diffusion
Investigation of siting parameters for near surface disposal of low-level nuclear waste. Final report, 11:11000 (R;US)
COBALT 59 TARGET
Heavy Ion Fusion Reactions
Fission-like phenomena for systems with mass A=110, 11:12312 (R;FR)
Neutron Reactions
Neutron scattering and reactions on 59Co from 1 to 20 MeV, 11:12323 (R;GB)
COBALT 60
Translocation
Comparison of predictions from internationally recognized assessment models for the transfer of selected radionuclides through terrestrial food chains, 11:11904 (J;US)
COBALT COMPLEXES
Oxidation
Redox reactivity of transition-metal phthalocyanines: ligand radical formation vs. metal center oxidation, 11:11682 (J;US)
COBALT COMPOUNDS
Mass Spectroscopy
Mass spectrometry of inductively coupled plasmas, 11:11624 (J;US)
Suppression of analyte signal by various concomitant salts in inductively coupled plasma mass spectrometry, 11:11625 (J;US)
COBALT IONS
X-Ray Spectra
Spectroscopy of Ldagger-series transitions for x-ray laser photopumping, 11:11760 (J;US)
COFFEE
See BEVERAGES
COGENERATION
Prior to November 1980, this concept was indexed to CO-GENERATION.
See COGENERATION
Investigation of fluid-bed combustion of municipal solid waste, 11:11483 (R;US)
COGENERATION PLANTS
See DUAL-PURPOSE POWER PLANTS
COHERENT ANTI-STOKES RAMAN SPECTROSCOPY
See RAMAN SPECTROSCOPY
COILS (MAGNETIC)
See MAGNET COILS
COLD STORAGE
Design
Use of ice storage equipment in the food industry, 11:11466 (RA;DE;In German)
COLEOPTILE
Cell Differentiation
Cell wall development in maize coleoptiles, 11:11958 (RA;US)
COLLIDER DETECTOR AT FERMILAB
See CDF
COLLIDING BEAMS
Supersymmetry
Supersymmetry: experimental signatures at hadron colliders, 11:12143 (R;CH)
COLLIERIES
See COAL MINES
COLLISION MATRIX
See S MATRIX
COLLISIONAL PLASMA
Raman Effect
LLE Review. Quarterly report, April-June 1985, 11:12488 (R;US)
COLLISIONLESS PLASMA
Electromagnetic Radiation
Electromagnetic wave propagation in relativistic magnetized plasmas, 11:12467 (J;US)
COLOGNE SPIRITS
See ETHANOL
COLOR MODEL
Algebra
Gentilion hypothesis for quark colours, 11:12239 (R;BR;In Portuguese)
COLUMNS (MECHANICAL)
See MECHANICAL STRUCTURES
COMBINED GAS AND STEAM CYCLE POWER PLANTS
See COMBINED-CYCLE POWER PLANTS
COMBINED STEAM-POWER GENERATION
See COGENERATION
COMBINED-CYCLE POWER PLANTS
Prior to March, 1976, the descriptors COMBINED CYCLES and FOSSIL-FUEL POWER PLANTS or THERMAL POWER PLANTS were used for indexing this concept.
Economic Analysis
Underground coal gasification commercialization concepts, 11:10756 (RA;US)
Feasibility Studies
Underground coal gasification commercialization concepts, 11:10756 (RA;US)
COMBUSTION
See also FLUIDIZED-BED COMBUSTION
REVERSE COMBUSTION
Additives
Measurements of distributed combustion. Annual report, March 1983-June 1984, 11:11781 (R;US)
Computer Calculations
Detailed model for practical pulverized coal furnaces and gasifiers. Quarterly technical progress report No. 2, August 1-October 31, 1985, 11:10910 (R;US)
Computer Codes
Detailed model for practical pulverized coal furnaces and gasifiers. Quarterly technical progress report No. 2, August 1-October 31, 1985, 11:10910 (R;US)
Data Analysis
SMOKE: a data reduction package for analysis of combustion experiments, 11:11740 (R;US)
Droplets
Droplet size and evaporation rate within a two-phase flow by morphology-dependent resonances in the optical spectra. Final report, 15 November 1981-31 December 1984, 11:11732 (R;US)
Efficiency
Effect of in-situ heat treatment on coal char reactivity. Ostwald equations and combustion efficiency in hydrocarbon and coal flames. Progress report, 11:10909 (R;US)
Equations of Motion
Shock-induced thermal runaway, 11:11733 (R;US)
Mathematical Models
Detailed model for practical pulverized coal furnaces and gasifiers. Quarterly technical progress report No. 2, August 1-October 31, 1985, 11:10910 (R;US)
Meetings
Preparation, handling, and storage, 11:10851 (RA;US)
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Research Programs
Conventional combustion, 11:10898 (RA;US)
Fuels combustion research, annual report, March 1, 1982-February 28, 1983, 11:11730 (R;US)
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Reviews
Fundamentals of coal dust combustion: recommendations for research on explosive limits of coal dust, 11:10897 (RA;US)
Two-Phase Flow
Droplet size and evaporation rate within a two-phase flow by morphology-dependent resonances in the optical spectra. Final report, 15 November 1981-31 December 1984, 11:11732 (R;US)
COMBUSTION PRODUCTS
Activation Analysis
Investigation of trace elements in domestic coal and its combustion products, as well as in industrial samples and ashes of special refuse by means of neutron activation analysis, 11:10801 (R;AT;In German)
Filtration
Ceramic filter elements for high-pressure, high-temperature gases, 11:11222 (R;US)

Gas Analysis
Effect of in-situ heat treatment on coal char reactivity. Ostwald equations and combustion efficiency in hydrocarbon and coal flames. Progress report, 11:10909 (R;US)
Hot Gas Cleanup
Hot gas cleanup for pressurized fluidized bed combustion burning low rank coal, 11:10903 (RA;US)
Multi-Element Analysis
Investigation of trace elements in domestic coal and its combustion products, as well as in industrial samples and ashes of special refuse by means of neutron activation analysis, 11:10801 (R;AT;In German)

COMBUSTION PROPERTIES
Bench-Scale Experiments
Use of laboratory combustion tube data in monitoring and designing UCG field tests, 11:10752 (RA;US)
Comparative Evaluations
Use of laboratory combustion tube data in monitoring and designing UCG field tests, 11:10752 (RA;US)
Mathematical Models
Use of laboratory combustion tube data in monitoring and designing UCG field tests, 11:10752 (RA;US)

COMBUSTION WAVES
Bench-Scale Experiments
Analysis of early cavity growth in underground coal gasification, 11:10767 (RA;US)
Functional Models
Theoretical and experimental studies of reverse combustion, 11:10763 (RA;US)
Infrared Thermography
Theoretical and experimental studies of reverse combustion, 11:10763 (RA;US)

COMBUSTORS
See also FLUIDIZED-BED COMBUSTORS
Mathematical Models
Detailed model for practical pulverized coal furnaces and gasifiers. Quarterly technical progress report No. 2, August 1-October 31, 1985, 11:10910 (R;US)
Performance Testing
Aerosol formation from pulverized coal combustion. Quarterly report No. 8, 11:10907 (R;US)
Aerosol formation from pulverized coal combustion. Quarterly report No. 7, 11:10906 (R;US)
Study on the ways of raising combustion efficiency and intensity of coal water slurry, 11:10873 (RA;US)
Reaction Kinetics
Measurement of rate constants of elementary gas reactions of importance to upper atmosphere and combustion systems. Final technical report, 1 September 1980-28 February 1985, 11:11731 (R;US)

COMMERCIAL BUILDINGS
See also SHOPPING CENTERS
Energy Conservation
Energy conservation in large buildings, 11:11452 (J;US)
Solar Water Heating
Potential applications of solar energy in the Republic of Panama, 11:11179 (RA;PR)
Space HVAC Systems
Energy conservation in large buildings, 11:11452 (J;US)

COMPLEXES
See also ALKALI METAL COMPLEXES
CHELATES
Chemical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Isomerization
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Physical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)

COMPOSITE MATERIALS
Ceramics
Fabrication of ceramic-ceramic composites by chemical vapor deposition, 11:11568 (J;US)
Fabrication
Fabrication of ceramic-ceramic composites by chemical vapor deposition, 11:11568 (J;US)

COMPOSITE MODELS
See also BOOTSTRAP MODEL
QUARK MODEL
Gauge Invariance
Gauge theory for composite fields, 11:12220 (R;BR)

COMPOUND NUCLEI
Decay
Unification of the Krylov-Fock theorem and solution of Davydov paradox of the decaying systems, 11:12371 (R;UA;In Russian)

COMPOUNDS (ORGANIC)
See ORGANIC COMPOUNDS

COMPRESSIBLE FLOW
Flow Models
Prediction of flow rates through an orifice at pressures corresponding to the transition between molecular and isentropic flow, 11:11763 (R;US)

COMPRESSOR BLADES
Boundary Layers
Analysis of the effects of transient heat transfer on axial-flow-compressor-blade boundary layers. Master's thesis, 11:11762 (R;US)
Heat Transfer
Analysis of the effects of transient heat transfer on axial-flow-compressor-blade boundary layers. Master's thesis, 11:11762 (R;US)

COMPRESSORS
See also GAS COMPRESSORS
Stored Energy
Analysis of the effects of transient heat transfer on axial-flow-compressor-blade boundary layers. Master's thesis, 11:11762 (R;US)

COMPUTED TOMOGRAPHY
See COMPUTERIZED TOMOGRAPHY

COMPUTER CODES
Computer codes are indexed by their initial letter and CODES, e.g., A CODES. If the code name begins with a number the code is indexed to NUMBER CODES.
See also H CODES
N CODES
Current methods for the dynamic analysis of horizontal axis wind turbines (FLAP: Force and Loads analysis programs), 11:11209 (J;US)
A Codes
Integrated Tiger Series of electron/photon Monte Carlo transport codes: a user's guide for use on IBM mainframes, 11:12386 (R;US)
Activity Levels
FORIG: a computer code for calculating radionuclide generation and depletion in fusion and fission reactors. User's manual, 11:12506 (R;US)
Air Flow
Computation of the transonic flow about a swept wing in the presence of an engine nacelle, 11:12127 (R;US)
B Codes
Calculational methods for analysis of postulated UF_6 releases. Volume 2 (FODRFT, INDRFT, BATCH, CYLIND, COMPLT, CYLPLT), 11:11078 (R;US)
New Monte Carlo electron transport code for beta dosimetry (BETRA code), 11:11830 (RA;AT)
C Codes
Calculational methods for analysis of postulated UF_6 releases. Volume 2 (FODRFT, INDRFT, BATCH, CYLIND, COMPLT, CYLPLT), 11:11078 (R;US)
Integrated Tiger Series of electron/photon Monte Carlo transport codes: a user's guide for use on IBM mainframes, 11:12386 (R;US)

Comparative Evaluations
Comparative analysis of constitutive relations in TRAC-PF1 and RELAP5/MOD1, 11:11234 (R;US)
D Codes
Core neutronics code development and application (DANDE), 11:11269 (RA;US)
E Codes
Advanced-fuel performance model Euges-Aries. Description and listing of the computer program and introduction to its use, 11:11258 (R;DE)
F Codes
Calculational methods for analysis of postulated UF_6 releases. Volume 2 (FODRFT, INDRFT, BATCH, CYLIND, COMPLT, CYLPLT), 11:11078 (R;US)
Computation of the transonic flow about a swept wing in the presence of an engine nacelle, 11:12127 (R;US)
Development and applications of two finite element groundwater flow and contaminant transport models: FEWA and FEMA, 11:11058 (R;US)
FORIG: a computer code for calculating radionuclide generation and depletion in fusion and fission reactors. User's manual, 11:12506 (R;US)
H Codes
HEADCO: a program for converting observed water levels and pressure measurements to formation pressure and standard hydraulic head, 11:12030 (R;US)
I Codes
Calculational methods for analysis of postulated UF_6 releases. Volume 2 (FODRFT, INDRFT, BATCH, CYLIND, COMPLT, CYLPLT), 11:11078 (R;US)
Integrated Tiger Series of electron/photon Monte Carlo transport codes: a user's guide for use on IBM mainframes, 11:12386 (R;US)
Isotope Production
FORIG: a computer code for calculating radionuclide generation and depletion in fusion and fission reactors. User's manual, 11:12506 (R;US)
L Codes
Modeling of complex melting and solidification behavior in laser-irradiated materials [a description and users guide to the LASER8 computer program], 11:11584 (R;US)
M Codes
Model documentation for the Mini-Macroeconomic Model: MINMAC, 11:11392 (R;US)
Multi-scattering-Xα method for analysis of the electronic structure of atomic clusters (MSXALPHA code), 11:12063 (R;CA)
N Codes
NEPTUNE: a finite element code for creeping flow of saturated cohesive porous media (Version 1.0), 11:12035 (R;US)
R Codes
Comparative analysis of constitutive relations in TRAC-PF1 and RELAP5/MOD1, 11:11234 (R;US)
FORTRAN program (RELAX3D) to solve the 3 dimensional Poisson (Laplace) equation, 11:12409 (R;CA)
RDEAM: an Adams ODE code with root solving capability, 11:12523 (R;US)
S Codes
SCORCH - a zero dimensional plasma evolution and transport code for use in small and large tokamak systems, 11:12425 (R;AU)
SIMBID: An alternative, simplified model of bidding and awarding of new natural gas reserves, 11:10960 (R;US)
SMOKE: a data reduction package for analysis of combustion experiments, 11:11740 (R;US)
T Codes
Comparative analysis of constitutive relations in TRAC-PF1 and RELAP5/MOD1, 11:11234 (R;US)
Integrated Tiger Series of electron/photon Monte Carlo transport codes: a user's guide for use on IBM mainframes, 11:12386 (R;US)
TOPAZ - the transient one-dimensional pipe flow analyzer: equations and numerics, 11:12132 (R;US)
TRAC-P1A independent assessment, 1979, 11:11326 (R;US)
TRAC-PF1/MOD1 independent assessment: LOBI large break transient A1-04R, 11:11330 (R;US)
V Codes
Computer modelling of an underground mine ventilation system (VENTRAD; VENTRPROG), 11:10977 (R;CA)

COMPUTER PROGRAMS
See COMPUTER CODES

COMPUTERIZED CONTROL SYSTEMS
Design
Micro-computer control VS 1000, 11:11441 (RA;DE;In German)
Performance
Micro-computer control VS 1000, 11:11441 (RA;DE;In German)
Performance Testing
Potential safety enhancements to nuclear plant control: Proof testing at EBR-II, 11:11277 (BA;US)

COMPUTERIZED SIMULATION
Plasma physics modeling and the Cray-2 multiprocessor, 11:12457 (R;US)
Validation
Computer simulation of the turbo-charged turbocompounded diesel engine system: a description of the thermodynamic and heat transfer models, 11:11487 (R;US)

COMPUTERIZED TOMOGRAPHY
An imaging technique in which transmission measurements of a narrow beam of rays, photons, or particles made at several different angles around an object may be used with a computer program to obtain a clear image of one plane
See also EMISSION COMPUTED TOMOGRAPHY
Comparative Evaluations
Determination of the left ventricular volumina by computerized tomography, as compared to laevo-angiocardiography, 11:11977 (R;DE;In German)

CONCENTRATING COLLECTORS
Design
Applications of maximally concentrating optics for solar energy collection, 11:11198 (J;US)
Optics
Applications of maximally concentrating optics for solar energy collection, 11:11198 (J;US)

CONCENTRATIONS (RADIONUCLIDES)
See RADIOACTIVITY

CONDENSATES
See also GAS CONDENSATES
Activation Analysis
Investigation of trace elements in domestic coal and its combustion products, as well as in industrial samples and ashes of special refuse by means of neutron activation analysis, 11:10801 (R;AT;In German)
Multi-Element Analysis
Investigation of trace elements in domestic coal and its combustion products, as well as in industrial samples and ashes of special refuse by means of neutron activation analysis, 11:10801 (R;AT;In German)

CONDENSED AROMATICS
See also ANTHRACENE
BENZOPYRENE
FLUORENE
NAPHTHALENE
PHENANTHRENE
PYRENE
Line Narrowing
Phosphorescence line narrowing of coronene and phenanthrene adsorbed on cellulose substrates, 11:11689 (J;US)
Phosphorescence
Phosphorescence line narrowing of coronene and phenanthrene adsorbed on cellulose substrates, 11:11689 (J;US)

CONDENSERS
Energy Balance
Investigation of air-cooled condensing units with hermetic twin compressors from the point of view of energetics, 11:11473 (RA;DE;In German)

CONDENSERS (ELECTRIC)
See CAPACITORS

CONDENSERS (STEAM)
See STEAM CONDENSERS

CONDUCTIVITY (THERMAL)
See THERMAL CONDUCTIVITY

CONFERENCES
See MEETINGS
CONNATE WATER
Isotope Ratio
Origin of fluid inclusion water in bedded salt deposits, Palo Duro Basin, Texas, 11:10998 (R;US)
Origin
Origin of fluid inclusion water in bedded salt deposits, Palo Duro Basin, Texas, 11:10998 (R;US)
CONSERVATION (ENERGY)
See ENERGY CONSERVATION
CONTACT RADIOTHERAPY
See RADIOTHERAPY
CONTAINERS
See also PRESSURE VESSELS
TANKS
Performance
BNL high-level waste technical assistance programs for support of the NRC, 11:11053 (J;US)
Stress Analysis
Stress analysis of the ROQUEFORT diagnostic canister by finite-element method, 11:11749 (R;US)
CONTAINMENT
See also CONTAINMENT BUILDINGS
CONTAINMENT SYSTEMS
Fission Product Release
Mechanistic determination of fission product releases for a Mark III BWR plant, 11:11297 (R;US)
Heat Transfer
Mechanistic determination of fission product releases for a Mark III BWR plant, 11:11297 (R;US)
Hydraulics
Mechanistic determination of fission product releases for a Mark III BWR plant, 11:11297 (R;US)
CONTAINMENT BUILDINGS
Floors
Reliability evaluation of containments including soil-structure interaction, 11:11332 (R;US)
Seismic Effects
Structural load combinations, 11:11225 (R;US)
Stress Analysis
Structural load combinations, 11:11225 (R;US)
CONTAINMENT SYSTEMS
Concept of underground nuclear power plant siting for retaining post accident atmospheres, 11:11354 (R;US)
Activity Levels
Accident assessment: role of the containment radiation monitor, 11:11340 (R;US)
Fission Product Release
Accident assessment: role of the containment radiation monitor, 11:11340 (R;US)
Pressure Gradients
Effects of reactor core-simulant aerosols on hydrogen/air combustion, 11:11349 (R;US)
Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels, 11:11348 (R;US)
Radiation Monitoring
Accident assessment: role of the containment radiation monitor, 11:11340 (R;US)
Risk Assessment
Probabilistic risk assessment of filtered-vented containment systems. Mark I BWR, 11:11345 (R;US)
Thermal Stresses
Estimates of early containment loads from core melt accidents. Draft report for comment, 11:11325 (R;US)
CONTAMINATION
Mathematical Models
Multiphase approach to the modeling of porous media contamination by organic compounds. I. Equation development, 11:11897 (J;US)
CONTENT ANALYSIS
See CHEMICAL ANALYSIS
CONTINENTAL SHELF
Offshore Drilling
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1980. Volume 6. Transport, 11:10945 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1980. Volume 7. Transport data management, 11:10946 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 3. Effects of contaminants, 11:10947 (R;US)
Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 6. Transport, 11:10950 (R;US)
Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 7. Hazards, 11:10951 (R;US)
Oil Spills
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 4. Effects of contaminants, 11:10948 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 5. Transport, 11:10949 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Final reports of principal investigators. Volume 18. Biological studies, 11:10953 (R;US)
Water Pollution
Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 7. Hazards, 11:10951 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 8. Hazards and data management, 11:10952 (R;US)
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 27, 11:10942 (R;US)
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 28, 11:10943 (R;US)
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 29, 11:10944 (R;US)
Water Pollution Control
Framework for oil-spill response on the Alaskan OCS (Outer Continental Shelf), 11:10940 (R;US)
CONTROL SYSTEMS
For automated processes including feedback.
See also COMPUTERIZED CONTROL SYSTEMS
ENTRY CONTROL SYSTEMS
REACTOR CONTROL SYSTEMS
Printed Circuits
Computer aided design, 11:11801 (RA;US)
CONTROLLED AREAS
Areas designated by radiation protection regulations for special monitoring.
Entry Control Systems
An activated barrier for protection of special nuclear materials in vital areas, 11:11102 (J;US)
CONVECTIVE LOOP HOUSES
See DOUBLE ENVELOPE BUILDINGS
CONVERTERS (ANALOG-DIGITAL)
See ANALOG-TO-DIGITAL CONVERTERS
COOK INLET
See GULF OF ALASKA
COOKING
See FOOD PROCESSING
COOLANT LOOPS
For reactors use REACTOR COOLING SYSTEMS or IN PILE LOOPS.
Corrosion
Effect of oxygen concentration on the corrosion of molybdenum in flowing water, 11:11788 (R;US)
COOLANT-FUEL INTERACTIONS
See FUEL-COOLANT INTERACTIONS
COOLERS
See HEAT EXCHANGERS

COOLING SYSTEM (REACTOR)
See REACTOR COOLING SYSTEMS
COOLING SYSTEMS
See also COOLANT LOOPS
REACTOR COOLING SYSTEMS
Refrigerants
Expansion chambers in the refrigeration circuit, 11:11475 (RA;DE;In German)
COPPER
Absorption Spectroscopy
New laser spectroscopic technique for stable-isotope ratio analysis, 11:11636 (D;US)
Auger Effect
Technique for comparing AES signals from different spectrometers using common materials, 11:11621 (R;US)
Catalytic Effects
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985, 11:11142 (R;US)
Electron Diffraction
Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
Epitaxy
Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
Ion Collisions
Charge changing cross sections of relativistic uranium, 11:12116 (J;NL)
Monocrystals
Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
Proton Reactions
Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)
Sorptive Properties
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
COPPER 63 TARGET
Antiproton Reactions
Description of antiproton-nucleus scattering with the proton-nucleus Dirac impulse approximation optical potential, 11:12300 (R;BR)
COPPER 64 TARGET
Alpha Reactions
Emission of light fragments ^{3}H, ^{3}He and ^{4}He in ^{4}He-nucleus collisions at 3.33 GeV/N kinetic energy, 11:12369 (R;SU)
COPPER ALLOYS
Physical Radiation Effects
Current research using the ANL High Voltage Electron Microscope Tandem Accelerator facility (Electron and ion irradiation), 11:11544 (J;NL)
Plasticity
Superplastic properties of an Al-Cu-Li-Zr alloy, 11:11542 (J;GB)
COPPER COMPLEXES
Oxidation
Redox reactivity of transition-metal phthalocyanines: ligand radical formation vs. metal center oxidation, 11:11682 (J;US)
COPPER IONS
Electron-Ion Collisions
Electron collisions with positive ions. Progress report, April 1, 1985-March 31, 1986, 11:12079 (R;US)
COPPER SELENIDE SOLAR CELLS
Fabrication
Stable, high-efficiency, $CuInSe_2$ - based polycrystalline thin-film tandem solar cells. Annual subcontract report, 16 March 1984-15 March 1985, 11:11164 (R;US)
Photoluminescence
Photoluminescence of $CuInSe_2$ photovoltaic cells. Final subcontract report, 1 April 1984-31 March 1985, 11:11167 (R;US)
Testing
Stable, high-efficiency, $CuInSe_2$ - based polycrystalline thin-film tandem solar cells. Annual subcontract report, 16 March 1984-15 March 1985, 11:11164 (R;US)
CORES (REACTOR)
See REACTOR CORES
CORN STOVER
See AGRICULTURAL WASTES
CORROSION
Research Programs
Corrosion Research Center of the University of Minnesota. Progress report, January 1-December 31, 1985, 11:11513 (R;US)
COSMIC MUONS
Prior to July, 1975 information was indexed to MUONS.
Energy Spectra
Physics with underground leptons of atmospheric origin, 11:12173 (J;US)
Radiation Flux
Physics with underground leptons of atmospheric origin, 11:12173 (J;US)
COSMIC NEUTRINOS
Prior to July, 1975 information was indexed to NEUTRINOS.
Radiation Detection
Underground neutrino astronomy, 11:12176 (J;US)
COSMIC NUCLEI
Prior to July , 1975 information was indexed to NUCLEI.
Hypernuclei
Hypernuclear gamma rays, 11:12036 (R;US)
COSMIC PARTICLES
See COSMIC RADIATION
COSMIC RADIATION
From sources other than the sun; not for SOLAR RADIATION.
See also COSMIC MUONS
COSMIC NEUTRINOS
COSMIC NUCLEI
Acceleration
Non-LTE astrophysics and the origin of high energy cosmic rays, 11:12052 (J;US)
COSMOGONY
See COSMOLOGY
COSMOLOGICAL CONSTANT
Supergravity
New contributions to the cosmological constant, 11:12041 (R;BR)
COSMOLOGICAL MODELS
Conformal Groups
Conformal group actions and Segal's cosmology, 11:12043 (R;BR)
Thermodynamics
Thermodynamic stability of cosmological models, 11:12045 (J;US)
COSMOLOGY
Astrophysics
Astrophysics. Volume 2. Interstellar matter and galaxies (Text book), 11:12050 (B;US)
Baryon Number
Mechanism for baryogenesis in supersymmetric inflationary cosmologies, 11:12044 (J;US)
Supersymmetry
Mechanism for baryogenesis in supersymmetric inflationary cosmologies, 11:12044 (J;US)
COSMOS
See UNIVERSE
COST
Data Base Management
Cost Data Management System User's Guide supplement. CDMS Version 2.2, 11:11156 (R;US)
Cost Data Management System. CDMS Version 2.2. Final report, 11:11155 (R;US)
Data Processing
Cost Data Management System. CDMS Version 2.2. Final report, 11:11155 (R;US)
COSTEAM PROCESS
Organic Solvents
LRC liquefaction reducing gas composition and moisture effects product yield, quality and operability, 11:10740 (RA;US)

Yields
LRC liquefaction reducing gas composition and moisture effects product yield, quality and operability, 11:10740 (RA;US)
COUMARIN
Emission Spectra
Laser induced coal fluorescence. Twelfth quarterly technical progress report, July 1-September 31, 1985, 11:10798 (R;US)
COUNTERS (RADIATION)
See RADIATION DETECTORS
COUNTY BUILDINGS
See PUBLIC BUILDINGS
COUPLINGS (MACHINE PARTS)
See MACHINE PARTS
COURT BUILDINGS
See PUBLIC BUILDINGS
COVERINGS
Erosion
Protection of uranium tailings impoundments against overland erosion, 11:11026 (R;US)
COW-MILKERS
See RADIOISOTOPE GENERATORS
CP INVARIANCE
Research Programs
[Review of experiments measuring CP nonconservation], 11:12154 (R;US)
Symmetry Breaking
[Review of experiments measuring CP nonconservation], 11:12154 (R;US)
CRACK GROWTH
See CRACK PROPAGATION
CRACK PROPAGATION
Computerized Simulation
Review of failure criteria for thin wall structures in a high heat flux environment, 11:12508 (R;US)
Mathematical Models
Review of failure criteria for thin wall structures in a high heat flux environment, 11:12508 (R;US)
CRAY COMPUTERS
Vector Processing
CFT compiler optimization and Cray X-MP vector performance, 11:12522 (R;US)
CRESOLS
Raman Spectroscopy
Multiresonant four-wave mixing spectroscopy of pentacene in naphthalene, 11:11688 (J;US)
CRESYLIC ACID
See CRESOLS
CRITICAL ASSEMBLIES
See ZERO POWER REACTORS
CRITICALITY ACCIDENTS
See RADIATION ACCIDENTS
CRNL SUPERCONDUCTING CYCLOTRON
Research Programs
Progress report: Physics Division, January 1-June 30, 1983, 11:12138 (R;CA)
CROSSED BEAMS
See COLLIDING BEAMS
CROWN ETHERS
See POLYETHYLENE GLYCOLS
CRUDE OIL
See PETROLEUM
CRYOSTATS
Equipment Protection Devices
Some problems of emergency protection of helium cryostats, 11:11745 (R;SU;In Russian)
CRYSTAL GROWTH
Kinetics
Morphology of a class of kinetic-growth models, 11:12417 (J;US)
CRYSTAL RIVER-3 REACTOR
Citrus, Florida, USA
Pumps
Safety Evaluation Report, Pump and Valve Inservice Testing Program, Crystal River, Unit 3 (Docket No. 50-302). Revision 1, 11:11239 (R;US)
Valves
Safety Evaluation Report, Pump and Valve Inservice Testing Program, Crystal River, Unit 3 (Docket No. 50-302). Revision 1, 11:11239 (R;US)
CRYSTALS
See also DENDRITES
LIQUID CRYSTALS
MONOCRYSTALS
Excitation
Electric field assisted dissociation of charge transfer states as a mechanism of photocarrier production, 11:11708 (J;US)
Phase Transformations
Phenomenological renormalization group calculations for 12- and 16- vertex models on a square lattice, 11:12397 (R;BR)
Photochemistry
Electric field assisted dissociation of charge transfer states as a mechanism of photocarrier production, 11:11708 (J;US)
Renormalization
Phenomenological renormalization group calculations for 12- and 16- vertex models on a square lattice, 11:12397 (R;BR)
Surface Properties
Effect of potassium on the chemisorption of carbon monoxide on the Rh(111)crystal face, 11:11666 (J;NL)
Ultrasonography
Investigations of ultrasonic wave interactions at boundaries separating anisotropic materials. Progress report, 11:11768 (R;US)
CULTURES (TISSUE)
See TISSUE CULTURES
CURIUM
Extraction Chromatography
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinide elements, 11:11613 (RA;XA)
CURIUM 244 TARGET
Neutron Reactions
Neutron-induced fission cross-section measurements of ^{244}Cm, ^{246}Cm, and ^{248}Cm, 11:12355 (J;US)
CURIUM 246 TARGET
Neutron Reactions
Neutron-induced fission cross-section measurements of ^{244}Cm, ^{246}Cm, and ^{248}Cm, 11:12355 (J;US)
CURIUM 248 TARGET
Neutron Reactions
Neutron-induced fission cross-section measurements of ^{244}Cm, ^{246}Cm, and ^{248}Cm, 11:12355 (J;US)
CURRENTS
Semiclassical Approximation
Semiclassical description of currents in normal and superfluid rotating nuclei, 11:12368 (R;FR)
CYCLES (THERMODYNAMIC)
See THERMODYNAMIC CYCLES
CYLINDERS
Objects of cylindrical shape. For containers see headings such as GAS CYLINDERS.
Technology Assessment
Energy recovered by using balloons and cylinders, 11:11207 (RA;PR)

D

D-1285 RESONANCES
Partial Waves
Partial wave analysis of KKPI system in D and E/IOTA region, 11:12140 (R;US)
DATA ACQUISITION SYSTEMS
Data Transmission
Design of a centralized network for data acquisition of wind, solar and environmental parameters by using the existing radio telemetry seismic network in Puerto Rico, 11:11206 (RA;PR)

Design
Data acquisition and testing at the Tennessee Energy Conservation in Housing (TECH) complex, 11:11442 (R;US)
Method and apparatus for I-V data acquisition from solar cells, 11:11172 (P;US)
Performance
Data acquisition and testing at the Tennessee Energy Conservation in Housing (TECH) complex, 11:11442 (R;US)

DATA COVARIANCES
Data uncertainties
Calculation Methods
Approach to error-estimation in the application of dimension algorithms, 11:12421 (R;US)

DATA TRANSMISSION
Fiber Optics
Design of a low-noise fiber-optic transmitter module, 11:11774 (R;US)

DATUM PRESSURE
See RESERVOIR PRESSURE

DCI ORSAY STORAGE RING
Operation
DCI operation balance during DM2,$\gamma\gamma$ - LURE - LEP vacuum - PS- vacuum experiments (September 1983-December 1984), 11:11813 (R;FR;In French)

DEBRIS (NUCLEAR)
See FISSION PRODUCTS

DECAHYDRONAPHTHALENE
See DECALIN

DECALIN
Hydrogenation
Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)

DECANE
Supercritical Fluid Chromatography
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)

DECANOLS
Supercritical Fluid Chromatography
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)

DECAY
For nuclear or particle decay only.
See also BETA DECAY
PARTICLE DECAY
Nuclear Data Collections
Coordination of the international network of nuclear structure and decay data evaluators. Summary report of a consultants' meeting organized by the IAEA and held at the Fachinformationszentrum in Karlsruhe, FRG, 3-6 April 1984, 11:12278 (R;XA)

DECAY HEAT REMOVAL
See AFTER-HEAT REMOVAL

DECIDUOUS TREES
See TREES

DECYL ALCOHOLS
See DECANOLS

DEEP INELASTIC SCATTERING
OPE Model
Structure functions of nuclei in the pion exchange model, 11:12356 (R;US)

DEES
Electrical Insulation
Study of the dee-to-dee shielding, 11:11785 (RA;US)

DEFENSE
See NATIONAL DEFENSE

DEFORMATION
Mathematical Models
Finite deformation of viscoelastic rotating disks, 11:11753 (J;GB)

DEFORMED NUCLEI
Moment of Inertia
Analysis of angular-momentum-projected Hartree-Fock-Bogoliubov wave functions in terms of interacting bosons, 11:12376 (J;NL)
Rotation
Semiclassical description of currents in normal and superfluid rotating nuclei, 11:12368 (R;FR)

DEGRADATION (NUCLEAR)
See DECAY

DELETIONS (CHROMOSOMAL)
See CHROMOSOMAL ABERRATIONS

DELTA RESONANCES (MESON)
See MESON RESONANCES

DELTA-966 RESONANCES
Quark Model
Nature of the scalar resonance delta (980), 11:12243 (R;SU)

DENDRITES
Crystal Growth
The first sidebranch instability of dendritic structures, 11:11547 (J;US)

DENITRIFICATION
Electrochemistry
Alternative method for the removal of oxides of nitrogen and sulfur from combustion processes. First quarterly technical status report, September 17-December 31, 1985, 11:10788 (R;US)

DENSITOMETERS
Design
New Compton densitometer for measuring pulmonary edema, 11:11979 (R;US)

DENSITY MATRIX
Equations of Motion
Dynamics of the nuclear one-body density: small amplitude regime, 11:12406 (R;BR)
Response Functions
Dynamics of the nuclear one-body density: small amplitude regime, 11:12406 (R;BR)

DEOXYPENTOSE NUCLEIC ACID
See DNA

DEOXYRIBONUCLEIC ACID
See DNA

DEPARTMENT OF INTERIOR
See US DOI

DEPLETION (ISOTOPIC)
See ISOTOPE SEPARATION

DEPOSITS (GEOLOGICAL)
See GEOLOGIC DEPOSITS

DESERTRON
See SUPERCONDUCTING SUPER COLLIDER

DESOXYRIBONUCLEIC ACID
See DNA

DESULFURIZATION
Electrochemistry
Alternative method for the removal of oxides of nitrogen and sulfur from combustion processes. First quarterly technical status report, September 17-December 31, 1985, 11:10788 (R;US)

DETECTORS (RADIATION)
See RADIATION DETECTORS

DETONATION WAVES
Wave Propagation
Theoretical evaluation of critical gas layer thickness in relation to detonation wave propagation, 11:11737 (RA;XA)

DEUTERIUM
Atom-Molecule Collisions
Effect of bending potential on calculated product-state distributions for the reaction H + D_2 yields HD + D, 11:12059 (R;US)
Isotope Effects
Deuterium isotope effects in condensed-phase thermochemical decomposition reactions of octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, 11:11694 (J;US)
Molecule-Molecule Collisions
State-to-state vibrational excitation of I_2 in collisions with H_2 and D_2, 11:12098 (J;US)
Structure Functions
Multiquark states in nuclei and the deep inelastic scattering, 11:12370 (R;SU)

DEUTERIUM OXIDES
See HEAVY WATER

DEUTERIUM TARGET
Deuteron Reactions
Low-energy nuclear reactions with hydrogen isotopes, 11:12290 (J;NL)
Measurement and application of DDsub(γ), DTsub(γ) and D^{3}Hesub(γ) reactions at low energy, 11:12291 (J;NL)
Search for quark deconfinement: Strangeness production in pp, dd, pα, and αα collisions at √s/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)
Pion Reactions
Real and virtual pions in nuclei, 11:12287 (R;FR;In French)
Tensor polarization of deuteron in πd and pd backward scattering and multiquark resonances, 11:12201 (R;SU)
Proton Reactions
Parity violation in ^{3}H (vector p/sub e/, p) H scattering, 11:11820 (RA;US)
Tensor polarization of deuteron in πd and pd backward scattering and multiquark resonances, 11:12201 (R;SU)
Triton Reactions
Low-energy nuclear reactions with hydrogen isotopes, 11:12290 (J;NL)
DEUTERON REACTIONS
Breakup Reactions
Polarization in three-nucleon breakup: Experiment and theory, 11:12289 (J;NL)
Capture
Measurement and application of DDsub(γ), DTsub(γ) and D^{3}Hesub(γ) reactions at low energy, 11:12291 (J;NL)
One-Nucleon Transfer Reactions
Correlation between the partial cross sections for the ^{174}Yb(n,2γ)^{175}Yb and ^{176}Yb(d,t)^{175}Yb reactions, 11:12335 (R;SU;In Russian)
Low-energy nuclear reactions with hydrogen isotopes, 11:12290 (J;NL)
Particle Production
Search for quark deconfinement: Strangeness production in pp, dd, pα, and αα collisions at √s/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)
Research Programs
Triangle Universities Nuclear Laboratory annual report - TUNL XXIV, 1 July 1984-31 August 1985, 11:12275 (R;US)
DEUTERON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
DEUTERON REACTIONS
DEVELOPING COUNTRIES
See also BRAZIL
DOMINICAN REPUBLIC
GREECE
INDIA
INDONESIA
ISRAEL
MEXICO
PANAMA
PHILIPPINES
REPUBLIC OF KOREA
TURKEY
Energy Source Development
Issues in the appraisal of energy projects for oil-importing developing countries. World Bank staff working paper, 11:11377 (R;US)
DEXTRIN
Crystal Structure
Circular and flip-flop hydrogen bonding in β-cyclodextrin undecahydrate: neutron diffraction study, 11:11697 (J;US)
Molecular Models
Hydrogen bonding patterns and dynamics in biological macromolecules, 11:11946 (R;US)
Neutron Diffraction
Circular and flip-flop hydrogen bonding in β-cyclodextrin undecahydrate: neutron diffraction study, 11:11697 (J;US)
DIAGNOSTIC TECHNIQUES
See also ELECTROENCEPHALOGRAPHY
TOMOGRAPHY
Risk Assessment
Evaluation of radiation risk resulting from diagnostic procedures that involve radionuclides, 11:11976 (RA;AT)
DIAMONDS
Electron Channeling
Channeling-radiation measurements at Lawrence Livermore National Laboratory, 11:11597 (J;NL)
Positron Channeling
Channeling-radiation measurements at Lawrence Livermore National Laboratory, 11:11597 (J;NL)
DIAPHRAGMS (THERMONUCLEAR DEVICE)
See LIMITERS
DIBARYON RESONANCES
Bag Model
Tensor polarization of deuteron in πd and pd backward scattering and multiquark resonances, 11:12201 (R;SU)
Decay
Evidence against a stable dibaryon from lattice QCD, 11:12214 (J;US)
Lattice Field Theory
Evidence against a stable dibaryon from lattice QCD, 11:12214 (J;US)
Mass Formulae
Evidence against a stable dibaryon from lattice QCD, 11:12214 (J;US)
DIBENZOPYRROLES
See CARBAZOLES
DIELECTRIC TRACK DETECTORS
Etching
Electrochemical development of particle tracks in CR-39 polymer dosimeter, 11:11836 (R;US)
Sensitivity
Present status of neutron detection in ATOMKI, 11:11831 (RA;AT)
DIESEL ENGINES
Design
Computer simulation of the turbo-charged turbocompounded diesel engine system: a description of the thermodynamic and heat transfer models, 11:11487 (R;US)
New diesel engine development for the use of vegetable oil as a fuel, 11:11500 (RA;DE;In German and English)
Fuel Substitution
Converting an agricultural tractor to biogas turbojet operation, 11:11486 (RA;DE;In German and English)
New diesel engine development for the use of vegetable oil as a fuel, 11:11500 (RA;DE;In German and English)
Practical experiences with rape-seed oil ester as fuel for tractors, 11:11501 (RA;DE;In German and English)
Ignition Systems
Converting an agricultural tractor to biogas turbojet operation, 11:11486 (RA;DE;In German and English)
Materials
Computer simulation of the turbo-charged turbocompounded diesel engine system: a description of the thermodynamic and heat transfer models, 11:11487 (R;US)
Performance
Emergency diesel generator operating experience, 1981-1983, 11:11235 (R;US)
Thermodynamic Cycles
Computer simulation of the turbo-charged turbocompounded diesel engine system: a description of the thermodynamic and heat transfer models, 11:11487 (R;US)
DIESEL FUELS
Mass Spectroscopy
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)
Supercritical Fluid Chromatography
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)
DIESEL OIL (FRACTION)
See DIESEL FUELS
DIFFERENTIAL EQUATIONS
Computer Codes
RDEAM: an Adams ODE code with root solving capability, 11:12523 (R;US)
DIFFRACTION (NEUTRON)
See NEUTRON DIFFRACTION
DIFFUSION
Analytical Solution
Analytical solution for a first-order reaction in a packed bed with diffusion, 11:11665 (J;US)

Markov Process
Trapping in stochastic mechanics and applications to covers of clouds and radiation belts, 11:12055 (R;FR)
Mathematical Models
Design and analysis of Cross-Appalachian Tracer Experiment (CAPTEX) field trials. Second annual progress report (CAPTEX), 11:11857 (R;US)
DIGESTER GAS
See METHANE
DIMENSIONS
Scaling Laws
Approach to error-estimation in the application of dimension algorithms, 11:12421 (R;US)
Hausdorff dimensions for sets with broken scaling symmetry, 11:12420 (R;US)
Scaling in fat fractals, 11:12521 (R;US)
DIMETHYLBENZENES
See XYLENES
1,2-DIPHENYLETHYLENE
See STILBENE
DIPHENYLPHOSPHINE OXIDE
See ORGANIC PHOSPHORUS COMPOUNDS
DIRAC EQUATION
Analytical Solution
SO(4) Reduction of the SU(N) Yang—Mills—Dirac equations, 11:12258 (J;US)
DISCHARGES (IONIZATION)
See IONIZATION
DISCHARGES (WASTES)
See WASTE DISPOSAL
DISEASE INCIDENCE
Mathematical Models
Health effects model for nuclear power plant accident consequence analysis. Part I. Introduction, integration, and summary. Part II. Scientific basis for health effects models, 11:11997 (R;US)
DISEASE RESISTANCE
Molecular Biology
Gene cloning as an approach to understanding specificity in plant-pathogen systems, 11:11964 (RA;US)
Physiology
Pectic fragments of plant cell walls as mediators of stress responses, 11:11934 (RA;US)
DISINTEGRATION (NUCLEAR)
See DECAY
DISINTEGRATION (NUCLEAR PARTICLE)
See ANNIHILATION
DISPERSANTS (CHEMICAL)
See SURFACTANTS
DISPERSION NUCLEAR FUELS
Thermal Conductivity
Thermal conductivities of U_3Si and U_3Si_2-Al dispersion fuels, 11:11280 (R;US)
DISPOSAL (WASTES)
See WASTE DISPOSAL
DISSOLVED OXYGEN
See OXYGEN
DISTILLATE FUEL
See HEATING OILS
DISTILLATE FUEL OIL
See HEATING OILS
DISTILLATION EQUIPMENT
See also RETORTS
Design
Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)
DISTRICT COOLING
Technology Assessment
District heating and cooling in the United States: prospects and issues, 11:11482 (R;US)
DISTRICT HEATING
Technology Assessment
District heating and cooling in the United States: prospects and issues, 11:11482 (R;US)
DISUSED MINESHAFTS
See ABANDONED SHAFTS
DIVERTORS
Crack Propagation
Review of failure criteria for thin wall structures in a high heat flux environment, 11:12508 (R;US)
DNA
Nondestructive Analysis
Densitometric nondestructive microassay for DNA quantitation, 11:11963 (J;US)
DNA ADDUCTS
Transcription
[Templates, site specifically modified with carcinogens]. Final report, 11:11947 (R;US)
DNA POLYMERASES
Biochemical Reaction Kinetics
[Templates, site specifically modified with carcinogens]. Final report, 11:11947 (R;US)
DNA REPAIR
Biochemistry
Carcinogenic potential of products produced by coal conversion processes. Final technical report, 11:11966 (R;US)
DODECANE
Piezometry
Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)
DOGS
Biological Radiation Effects
Immunologic and hematologic perturbations in models of combined injury, 11:11989 (R;US)
Injuries
Immunologic and hematologic perturbations in models of combined injury, 11:11989 (R;US)
DOMESTIC WASTES
See MUNICIPAL WASTES
DOMINICAN REPUBLIC
Petroleum Refineries
Alcohols and ideas for savings of petroleum crude at local refineries in the Caribbeans, 11:11136 (RA;PR)
DOPED MATERIALS
Chemical Preparation
Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs, 11:11598 (J;US)
Czochralski Method
Research in gadolinium scandium gallium garnet (GSGG) crystal development. Final report, 1 May-31 December 1984 (Nd:Cr:GSGG), 11:11757 (R;US)
Electrical Properties
Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs, 11:11598 (J;US)
Grain Boundaries
Influence of anisotropy and doping on grain boundary diffusion in oxide systems, 11:11566 (J;NL)
Photochemistry
Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs, 11:11598 (J;US)
DORMITORIES
See RESIDENTIAL BUILDINGS
DOSEMETERS
See also BIOLOGICAL DOSEMETERS
Calibration
Possible secondary standard for lethal dose measurements in radiological research and accident dosimetry, 11:11827 (RA;AT)
Computerized Control Systems
Portable neutron spectrometer and dosimeter, 11:11838 (P;US)
Design
Portable neutron spectrometer and dosimeter, 11:11838 (P;US)
DOSIMETERS
See DOSEMETERS
DOSIMETRY
See also BETA DOSIMETRY
GAMMA DOSIMETRY
MICRODOSIMETRY
NEUTRON DOSIMETRY
PERSONNEL DOSIMETRY
THERMOLUMINESCENT DOSIMETRY

Comparative Evaluations
Introduction to the USUR data, 11:12001 (R;US)
Research Programs
Armed Forces Radiobiology Research Institute annual research report, Fiscal Year 1984, 11:11986 (R;US)
Response Modifying Factors
Factors affecting the assessment of lung depositions of transuranics, 11:12000 (R;US)
DOUBLE ENVELOPE BUILDINGS
Technology Transfer
BTESM National Program: past, present, and future, 11:11418 (R;US)
DOUBLE SHELL HOUSES
See DOUBLE ENVELOPE BUILDINGS
DOUBLE WALL HOUSES
See DOUBLE ENVELOPE BUILDINGS
DOUBLET 3 DEVICES
See DOUBLET REACTORS
DOUBLET REACTORS
Plasma Diagnostics
Multichordal charge exchange recombination spectroscopy on the Doublet III tokamak, 11:12459 (J;US)
DPO
See ORGANIC PHOSPHORUS COMPOUNDS
DRAGLINES
Data Acquisition Systems
System for gathering dragline data using an electronic data logger and modem, 11:10817 (R;CA)
Mathematical Models
System for gathering dragline data using an electronic data logger and modem, 11:10817 (R;CA)
DRIFT CHAMBERS
Design
Soudan nucleon decay experiments, 11:11844 (J;US)
Performance
D/sub phi/ experiment at TeV I, 11:12153 (RA;US)
Soudan nucleon decay experiments, 11:11844 (J;US)
DRIFT INSTABILITY
Renormalized turbulence theory of ion pressure gradient driven drift modes, 11:12432 (R;US)
DRIFT (PLASMA)
See PLASMA DRIFT
DRINKING WATER
Radiation Monitoring
Environmental Radiation Data report 29: January-March 1982, 11:11883 (R;US)
Environmental Radiation Data report 28: October-December 1981, 11:11884 (R;US)
DROPLETS
Particle Size
Photographic and Malvern analysis of coal-water slurry atomization, 11:10866 (RA;US)
DRY SCRUBBERS
Mathematical Models
Modeling of spray dryer desulfurization, 11:11220 (RA;US)
DRY STORAGE
Research Programs
Commercial Nuclear Waste Research and Development Program. Annual report, fiscal year 1985, 11:10989 (R;US)
DRYERS
See also SOLAR DRYERS
Design
Nonsaturable microdryer, 11:11779 (P;US)
Electrodes
Nonsaturable microdryer, 11:11779 (P;US)
Electrolytes
Nonsaturable microdryer, 11:11779 (P;US)
Manuals
Solar and energy-conserving food technologies: a training manual, 11:11195 (R;US)
DTO
See HEAVY WATER
TRITIUM COMPOUNDS
DUAL-PURPOSE POWER PLANTS
Heating Systems
Cogeneration units and heat pumps for public swimming pools - a report on practical experience, 11:11439 (RA;DE;In German)
Swimming Pools
Cogeneration units and heat pumps for public swimming pools - a report on practical experience, 11:11439 (RA;DE;In German)
DUSTS
Combustion
Fundamentals of coal dust combustion: recommendations for research on explosive limits of coal dust, 11:10897 (RA;US)
Detonation Limits
Fundamentals of coal dust combustion: recommendations for research on explosive limits of coal dust, 11:10897 (RA;US)
DYE LASERS
Design
[Laser energetics quarterly report, January-March 1985]. Volume 22, 11:12430 (R;US)
DYMAC SYSTEM
See NUCLEAR MATERIALS MANAGEMENT
PLUTONIUM
DYNAMIC MATERIALS ACCOUNTABILITY SYSTEM
See NUCLEAR MATERIALS MANAGEMENT
PLUTONIUM
DYNAMICS
Global Analysis
Markov-Tree model of intrinsic transport in Hamiltonian systems, 11:12416 (J;US)
DYNAMICS (BEAM)
See BEAM DYNAMICS

E

E-1422 RESONANCES
Partial Waves
Partial wave analysis of KKPI system in D and E/IOTA region, 11:12140 (R;US)
EARTH ATMOSPHERE
See also EARTH MAGNETOSPHERE
IONOSPHERE
Gases
Measurement of rate constants of elementary gas reactions of importance to upper atmosphere and combustion systems. Final technical report, 1 September 1980-28 February 1985, 11:11731 (R;US)
Markov Process
Trapping in stochastic mechanics and applications to covers of clouds and radiation belts, 11:12055 (R;FR)
EARTH MAGNETOSPHERE
See also PLASMA SHEET
Wave Propagation
Effects of whistler-mode and other waves in the magnetosphere. Final report 1981-1984, 11:12053 (R;US)
Whistlers
Effects of whistler-mode and other waves in the magnetosphere. Final report 1981-1984, 11:12053 (R;US)
EAST COAST
Petroleum Refineries
Alcohols and ideas for savings of petroleum crude at local refineries in the Caribbeans, 11:11136 (RA;PR)
EBIC
See SCANNING ELECTRON MICROSCOPY
EBR-2 REACTOR
Computerized Control Systems
Potential safety enhancements to nuclear plant control: Proof testing at EBR-II, 11:11277 (BA;US)
Loss of Flow
EBR-II Shutdown Heat Removal Testing Program results and plans, 11:11299 (R;US)
Reactor Control Systems
Potential safety enhancements to nuclear plant control: Proof testing at EBR-II, 11:11277 (BA;US)
ECCS
Heat Transfer
MELRPI - development and use, 11:11301 (R;US)

Research program on mechanical and thermodynamic interactions between principal vapor flow and emergency water injection in a PWR reactor. Volume I. (Part I. EPIS I Experiment) Test Operations, 1975-1976, 11:11357 (TG;US)
Hydraulics
MELRPI - development and use, 11:11301 (R;US)
Research program on mechanical and thermodynamic interactions between principal vapor flow and emergency water injection in a PWR reactor. Volume I. (Part I. EPIS I Experiment) Test Operations, 1975-1976, 11:11357 (TG;US)
Reliability
Monte Carlo simulation assessment of emergency core cooling system reliability of nuclear power plants, 11:11317 (RA;CS;In Czech)

ECONOMIC DEVELOPMENT
Federal Assistance Programs
Financial and Compliance Report on Federally Assisted Programs for the year ended June 30, 1984, 11:11376 (R;US)

ECONOMICS
Comparative Evaluations
Breeder reactor economics, 11:11265 (R;US)

ECR HEATING
Efficiency
Review of electron cyclotron heating experiments in toroidal devices, 11:12439 (R;US)
Research Programs
Review of electron cyclotron heating experiments in toroidal devices, 11:12439 (R;US)

EDDY CURRENTS
Limited to electric currents.
Two-Dimensional Calculations
Eddy currents in a nonperiodic vacuum vessel induced by axisymmetric plasma motion, 11:12500 (R;US)

EDEMA
Diagnosis
New Compton densitometer for measuring pulmonary edema, 11:11979 (R;US)

EDS LIQUEFACTION
See EXXON LIQUEFACTION PROCESS

EFFLUENTS (CHEMICAL)
See CHEMICAL EFFLUENTS

EFFLUENTS (GASEOUS)
See GASEOUS WASTES

EFFLUENTS (LIQUID)
See LIQUID WASTES

EFFUSION
See DIFFUSION

EHF RADIATION
See MICROWAVE RADIATION

EINSTEIN-DE SITTER MODEL
See COSMOLOGICAL MODELS

ELECTRIC BATTERIES
Devices for production and/or storage of electrical energy from chemical reactions; excludes FUEL CELLS and RADIOISOTOPE BATTERIES.
See also LEAD-ACID BATTERIES
Cathodes
Lithium insertion in $V_3Nb_6O_{29}$. A Wadsley-Roth type phase. Technical report, June 1984-July 1985, 11:11361 (R;US)
Cost
Energy Storage Technical and Economic Analysis Program. Annual report, 11:11371 (R;US)
Current Density
Electrode kinetic measurements of very fast reactions: metal deposition-dissolution in molten halides, 11:11366 (R;US)
Economic Analysis
Analysis of a customer-side-of-the-meter storage battery facility, 11:11218 (R;US)
Failures
Energy Storage Technical and Economic Analysis Program. Annual report, 11:11371 (R;US)
Heating
Testing and development of electric vehicle batteries for EPRI Electric Transportation Program. Technical report for November 1982-December 1984, 11:11362 (R;US)
Kinetics
Electrode kinetic measurements of very fast reactions: metal deposition-dissolution in molten halides, 11:11366 (R;US)
Meetings
First international workshop on battery testing, 30 September-2 October 1985, Heidelberg, FRG. Summary report, 11:11364 (R;US)
First international workshop on battery testing. Workbook and extended abstracts. Summaries, 11:11368 (R;US)
Project summaries: seventh battery and electrochemical contractors' conference, 11:11365 (R;US)
Performance Testing
Testing activities at the National Battery Test Laboratory, 11:11363 (R;US)
Testing and development of electric vehicle batteries for EPRI Electric Transportation Program. Technical report for November 1982-December 1984, 11:11362 (R;US)
Research Programs
Exploratory Battery Technology Development and Testing report for 1984, 11:11372 (R;US)
Reviews
Status of electric vehicle battery development and manufacturing activities outside of the United States, 11:11494 (R;US)
Technology Assessment
Energy Storage Technical and Economic Analysis Program. Annual report, 11:11371 (R;US)
Technology Transfer
Energy Storage Technical and Economic Analysis Program. Annual report, 11:11371 (R;US)
Test Facilities
Testing activities at the National Battery Test Laboratory, 11:11363 (R;US)
Testing
First international workshop on battery testing, 30 September-2 October 1985, Heidelberg, FRG. Summary report, 11:11364 (R;US)
First international workshop on battery testing. Workbook and extended abstracts. Summaries, 11:11368 (R;US)

ELECTRIC CONDENSERS
See CAPACITORS

ELECTRIC FIELDS
Biological Effects
Biological effects of electric fields, 11:12024 (R;US)
Biological studies of swine exposed to 60-Hz electric fields. Volume 3. Exposure system and dosimetry. Final report, 11:12019 (R;US)
Biological studies of swine exposed to 60-Hz electric fields. Volume 2: Behavior. Final report, 11:12018 (R;US)
Biological studies of swine exposed to 60-Hz electric fields. Volume 1. Overview and summary. Final report, 11:12017 (R;US)
Biological studies of swine exposed to 60-Hz electric fields. Volume 7. Neurology. Final report, 11:12023 (R;US)
Biological studies of swine exposed to 60-Hz electric fields. Volume 6. Immunology. Final report, 11:12022 (R;US)
Biological studies of swine exposed to 60-Hz electric fields. Volume 5. Hematology and serum chemistry. Final report, 11:12021 (R;US)
Effects of 60 Hz electric fields on operant and social stress behavior of nonhuman primates. Quarterly technical progress report No. 20, September 28-December 20, 1985, 11:12016 (R;US)
Viabilities and mutation frequencies of CHO-K1 cells following exposure to 60-Hz electric fields, 11:12025 (R;US)
Computerized Simulation
Equilibrium fluctuation energy of gyrokinetic plasma, 11:12451 (R;US)
Exposure Chambers
Biological studies of swine exposed to 60-Hz electric fields. Volume 3. Exposure system and dosimetry. Final report, 11:12019 (R;US)
Fluctuations
Equilibrium fluctuation energy of gyrokinetic plasma, 11:12451 (R;US)
Genetic Effects
Biological studies of swine exposed to 60-Hz electric fields. Volume 1. Overview and summary. Final report, 11:12017 (R;US)

Mapping
[Glass Development Laser (GDL) Facility upgrade.] LLE Review. Quarterly report, October-December 1984. Volume 21, 11:12487 (R;US)
Mutagenesis
Viabilities and mutation frequencies of CHO-K1 cells following exposure to 60-Hz electric fields, 11:12025 (R;US)
Teratogenesis
Biological studies of swine exposed to 60-Hz electric fields. Volume 4: growth, reproduction, and development. Final report, 11:12020 (R;US)

ELECTRIC MOTORS
Energy Efficiency
Optimization of induction motor efficiency. Volume 3. Experimental comparison of three-phase standard motors with Wanlass motors. Final report, 11:11478 (R;US)

ELECTRIC POWER SYSTEMS
See POWER SYSTEMS

ELECTRIC UTILITIES
Load Management
Analysis of a customer-side-of-the-meter storage battery facility, 11:11218 (R;US)
Marketing Research
Value-based utility planning: scoping study. Final report, 11:11401 (R;US)
Planning
Value-based utility planning: scoping study. Final report, 11:11401 (R;US)

ELECTRICAL BREAKDOWN
See ELECTRICAL FAULTS

ELECTRICAL FAULTS
Detection
The application of synchronous clocks for power system fault location, control and protection, 11:11224 (BA;US)

ELECTRIC-POWERED VEHICLES
Electric Batteries
First international workshop on battery testing. Workbook and extended abstracts. Summaries, 11:11368 (R;US)
Sodium-sulfur battery development. Phase VB, October 1, 1981-February 28, 1985. Final report, 11:11369 (R;US)
Status of electric vehicle battery development and manufacturing activities outside of the United States, 11:11494 (R;US)
Testing and development of electric vehicle batteries for EPRI Electric Transportation Program. Technical report for November 1982-December 1984, 11:11362 (R;US)
Technology Assessment
Role of electric vehicles in the nation's energy future, 11:11493 (R;US)

ELECTROCHEMICAL CELLS
See also ELECTRIC BATTERIES
FUEL CELLS
PHOTOELECTROCHEMICAL CELLS
Meetings
Project summaries: seventh battery and electrochemical contractors' conference, 11:11365 (R;US)

ELECTROENCEPHALOGRAPHY
Data Analysis
Problems associated with dimensional analysis of electroencephalogram data, 11:11978 (R;US)

ELECTROLINKING
Infrared Thermography
Modeling and experimental studies of electrolinking, 11:10764 (RA;US)
Performance
Modeling and experimental studies of electrolinking, 11:10764 (RA;US)

ELECTROLYTIC CELLS
Photovoltaic Power Supplies
Photovoltaic-powered solid polymer electrolyte (SPE) electrolyzer system evaluation. Final report, 11:11120 (R;US)

ELECTROMAGNETIC ISOTOPE SEPARATORS
See also TRISTAN SEPARATOR
Uses
Study of magnetic moments of nuclear excited states at TRISTAN, 11:12283 (J;NL)

ELECTROMAGNETIC PULSES
Simulators
Study to simulate high altitude EMP surges induced in overhead power lines. Final report, 11:11856 (R;US)

ELECTRON ACCEPTOR
See ELECTRONS

ELECTRON ACOUSTIC WAVES
See ELECTRON PLASMA WAVES

ELECTRON ANTINEUTRINOS
Energy Spectra
Indication of neutrino oscillation from the Bugey experiment, 11:12160 (R;FR)
Recent results from the Bugey neutrino oscillation experiment, 11:12159 (R;FR)

ELECTRON BEAM INDUCED CURRENT
See SCANNING ELECTRON MICROSCOPY

ELECTRON BEAMS
Beam Production
Magnetic-field extraction and filamentation of high-current electron beams, 11:12094 (J;US)
Growth
Emittance growth from radiation fluctuations, 11:11790 (R;US)
Oscillations
Kinetic description of harmonic instabilities in a planar wiggler free-electron laser, 11:11759 (J;US)

ELECTRON COLLISIONS
See also ELECTRON-ATOM COLLISIONS
ELECTRON-ION COLLISIONS
Bremsstrahlung
Atomic effects of electrons and protons at low energies, 11:12066 (R;US)
Ionization
Atomic effects of electrons and protons at low energies, 11:12066 (R;US)

ELECTRON CONFIGURATION (ATOMS)
See ELECTRONIC STRUCTURE

ELECTRON CYCLOTRON MASERS
See MICROWAVE AMPLIFIERS

ELECTRON CYCLOTRON-RESONANCE HEATING
See ECR HEATING

ELECTRON DETECTION
Mathematical Models
Improved model of electron interaction with matter to be used for calculation of detector's response function, 11:11832 (RA;AT)
Semiconductor Detectors
Improved model of electron interaction with matter to be used for calculation of detector's response function, 11:11832 (RA;AT)

ELECTRON DONOR
See ELECTRONS

ELECTRON GAS
Compton Effect
Discretization methods for one-dimensional Fokker-Planck operators, 11:12423 (J;US)
Response Functions
Exact dynamically convergent calculations of the frequency-dependent density response function, 11:12418 (J;US)

ELECTRON MOBILITY
Pressure Dependence
Effect of high pressure on the electron mobility in liquid n-hexane, 2,2-dimethylbutane, and tetramethylsilane, 11:11686 (J;US)

ELECTRON MULTIPLIER DETECTORS
Time Resolution
Study and realization of a parallel plate avalanche counter used for time of flight and localization measurements, 11:11834 (R;FR;In French)

ELECTRON PAIRS
Pair Production
PLUTO collaboration: e^+e^- interactions at PETRA, 11:12147 (RA;US)
Status and future of the experiment PS 170 (anti $pp \rightarrow e^+e^-$), 11:12142 (R;FR)

ELECTRON PLASMA WAVES
Damping
Review of electron cyclotron heating experiments in toroidal devices, 11:12439 (R;US)
Kink Instability
Stability of electron cyclotron waves in the presence of strong electron cyclotron heating, 11:12440 (R;US)
ELECTRON REACTIONS
Breakup Reactions
Structure of the $^3H \rightarrow n + d(d^*)$ vertexes, 11:12292 (BA;NL)
Inelastic Scattering
Future prospects in photon and electron physics at Saclay, 11:12357 (R;FR)
Possibility of excitation twist mode selection in the (e, e') reaction, 11:12330 (R;SU;In Russian)
Quadrupole boson densities in the germanium region by inelastic electron scattering, 11:12328 (R;FR)
Total Cross Sections
Photoneutron cross sections, 11:12334 (R;BR)
Vertex Functions
Structure of the $^3H \rightarrow n + d(d^*)$ vertexes, 11:12292 (BA;NL)
ELECTRON TRANSFER
Not for CHARGE EXCHANGE.
Absorption Spectroscopy
Recent picosecond spectroscopy studies of photoactivated electron transfer reactions in solution, 11:11157 (R;FR)
Fluorescence Spectroscopy
Recent picosecond spectroscopy studies of photoactivated electron transfer reactions in solution, 11:11157 (R;FR)
ELECTRON-ATOM COLLISIONS
Excitation
Many-Body theory of electron impact excitation from metastable targets, 11:12126 (BA;NL)
Many-Body Problem
Many-Body theory of electron impact excitation from metastable targets, 11:12126 (BA;NL)
ELECTRONIC CIRCUITS
See also PRINTED CIRCUITS
SWITCHING CIRCUITS
Design
Baseline compensation circuit for measurement of transient signals, 11:11776 (J;US)
ELECTRONIC EQUIPMENT
See also AMPLIFIERS
ANALOG-TO-DIGITAL CONVERTERS
MICROWAVE EQUIPMENT
POWER SUPPLIES
Drying
Nonsaturable microdryer, 11:11779 (P;US)
ELECTRONIC STRUCTURE
For electron configuration in atoms and molecules, and electron band structure in solids.
Computer Calculations
Multi-scattering-Xα method for analysis of the electronic structure of atomic clusters (MSXALPHA code), 11:12063 (R;CA)
Hartree-Fock Method
Time dependent Hartree-Fock theory of ion-atom collisions: Application to F^{9+} + Ne, 11:12103 (J;NL)
ELECTRON-ION COLLISIONS
Cross Sections
Electron collisions with positive ions. Progress report, April 1, 1985-March 31, 1986, 11:12079 (R;US)
Inner-Shell Ionization
Indirect processes in electron impact ionization of multiply-charged ions, 11:12106 (J;NL)
ELECTRON-POSITRON INTERACTIONS
Annihilation
Capabilities of e^+e collisions for producing very heavy Higgs bosons, 11:12216 (J;NL)
Study of hadronization using energy flow from e^+e^- annihilation into quarks and gluons at $\sqrt{s}$ of 29 GeV, 11:12163 (R;US)
Multiple Production
PLUTO collaboration: e^+e^- interactions at PETRA, 11:12147 (RA;US)
Pair Production
PLUTO collaboration: e^+e^- interactions at PETRA, 11:12147 (RA;US)
Possibility to study electromagnetic properties of neutral pions in experiments with electron-positron colliding beams, 11:12187 (R;SU;In Russian)
Particle Production
JADE: search for new particles and tests of Standard Model, 11:12146 (RA;US)
Radiation Detectors
Physics with the crystal ball detector, 11:11841 (J;US)
Total Cross Sections
Exact calculations of the lowest-order electromagnetic corrections for the processes $e^+e^- \rightarrow \mu^+\mu^-(tau^+tau^-)$, 11:12203 (R;SU)
ELECTRONS
Binding Energy
X-Ray Data Booklet. Center for X-Ray Optics (Tables), 11:12385 (R;US)
Compton Effect
Monte Carlo sampling of Compton scatter off moving electrons, 11:12122 (J;US)
Range
X-Ray Data Booklet. Center for X-Ray Optics (Tables), 11:12385 (R;US)
ELECTROSLAG CASTING
Evaluation
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1985, 11:10790 (R;US)
ELEMENTS
For chemical elements only.
See also METALS
Binding Energy
X-Ray Data Booklet. Center for X-Ray Optics (Tables), 11:12385 (R;US)
Boiling Points
X-Ray Data Booklet. Center for X-Ray Optics (Tables), 11:12385 (R;US)
Density
X-Ray Data Booklet. Center for X-Ray Optics (Tables), 11:12385 (R;US)
Ionization Potential
X-Ray Data Booklet. Center for X-Ray Optics (Tables), 11:12385 (R;US)
Melting Points
X-Ray Data Booklet. Center for X-Ray Optics (Tables), 11:12385 (R;US)
Mineral Cycling
Heavy metals and other trace elements, 11:11917 (J;US)
Molecular Weight
X-Ray Data Booklet. Center for X-Ray Optics (Tables), 11:12385 (R;US)
Specific Heat
X-Ray Data Booklet. Center for X-Ray Optics (Tables), 11:12385 (R;US)
Toxicity
Heavy metals and other trace elements, 11:11917 (J;US)
ELMO BUMPY TORUS
Electric Discharges
Power balance in ELMO Bumpy Torus: bulk electrons and ions in a 37 kW discharge, 11:12447 (R;US)
Emission Spectra
Comparative measurement of the neutral density and particle confinement time in EBT, 11:12444 (R;US)
Energy Balance
Power balance in ELMO Bumpy Torus: bulk electrons and ions in a 37 kW discharge, 11:12447 (R;US)
Plasma Confinement
Comparative measurement of the neutral density and particle confinement time in EBT, 11:12444 (R;US)
EMERGENCY CORE COOLING SYSTEM
See ECCS

EMERGENCY PLANS
Recommendations
Guidelines for preparing emergency procedures for nuclear power plants, 11:11327 (R;US)
EMERGENCY PROVISIONS
See EMERGENCY PLANS
EMISSION COMPUTED TOMOGRAPHY
Data Processing
Contribution to regularizing iterative method development for attenuation correction in gamma emission tomography, 11:11974 (R;FR;In French)
EMP
See ELECTROMAGNETIC PULSES
EMPLOYEES
See PERSONNEL
END USE SECTOR
See INDUSTRY
RESIDENTIAL SECTOR
ENDF
See NUCLEAR DATA COLLECTIONS
ENDOSPERM
Biochemistry
Ultrastructure and biochemistry of endosperm breakdown in date palm (Phoenix dactylifera L.) seeds, 11:11938 (RA;US)
Biodegradation
Ultrastructure and biochemistry of endosperm breakdown in date palm (Phoenix dactylifera L.) seeds, 11:11938 (RA;US)
ENDOSTEUM
See BONE TISSUES
ENERGY CONSERVATION
Corrosion Protection
Energy Storage Technical and Economic Analysis Program. Annual report, 11:11371 (R;US)
Economic Impact
Energy conservation in large buildings, 11:11452 (J;US)
Meetings
Energy sources: conservation and renewables, 11:11450 (B;US)
ENERGY CONSUMPTION
See also FUEL CONSUMPTION
Energy Models
Engineering/economic end-use energy models, 11:11375 (J;US)
ENERGY DEMAND
Forecasting
Model documentation for the Mini-Macroeconomic Model: MINMAC, 11:11392 (R;US)
ENERGY EFFICIENCY
Economic Analysis
Residential energy efficiency: progress since 1973 and future potential (Cost of conserved concept), 11:11451 (J;US)
Economic Impact
Economics of efficiency improvements in residential appliances and space conditioning equipment, 11:11455 (J;US)
Technology Utilization
Residential energy efficiency: progress since 1973 and future potential (Cost of conserved concept), 11:11451 (J;US)
ENERGY FACILITIES
See also RESOURCE RECOVERY FACILITIES
Safety
DOE natural phenomena hazards mitigation conference: proceedings, 11:11769 (R;US)
ENERGY MANAGEMENT
Ten-Year Inhouse Energy Management Plan, 11:11444 (R;US)
ENERGY MODELS
Model of the use of coal, gas, and oil (Brookhaven Energy System Optimization Model (BESOM)), 11:11398 (J;GB)
M Codes
Model documentation for the Mini-Macroeconomic Model: MINMAC, 11:11392 (R;US)
Performance
Engineering/economic end-use energy models, 11:11375 (J;US)
Sectoral Analysis
Engineering/economic end-use energy models, 11:11375 (J;US)
ENERGY SOURCE DEVELOPMENT
Program and financial report on Department of Energy, 11:11385 (R;US)
Constraints
Opportunities for biomass energy projects in the State of California, 11:11124 (RA;PR)
Cost Benefit Analysis
Issues in the appraisal of energy projects for oil-importing developing countries. World Bank staff working paper, 11:11377 (R;US)
Demonstration Programs
Opportunities for biomass energy projects in the State of California, 11:11124 (RA;PR)
Environmental Impacts
Impact of geothermal development on the state of Hawaii. Executive summary. Volume 7, 11:11200 (R;US)
Federal Assistance Programs
Financial and Compliance Report on Federally Assisted Programs for the year ended June 30, 1984, 11:11376 (R;US)
Forecasting
Energy perspectives - 1984, 11:11379 (RA;US)
Research Programs
Hawaii Natural Energy Institute annual report, July 1982-June 1983, 11:11405 (R;US)
ENERGY STORAGE
Research Programs
Energy Storage Technical and Economic Analysis Program. Annual report, 11:11371 (R;US)
ENERGY SUPPLIES
Compiled Data
Identification of state-level energy data available from the Energy Information Administration, Private Sector Sources, and State Offices, 11:11393 (R;US)
Data
Greece - energy situation 1983/1984, 11:11394 (R;DE;In German)
Indonesia - energy situation 1983/1984, 11:11395 (R;DE;In German)
ENGINEERED SAFETY SYSTEMS
See also AIR CLEANING SYSTEMS
CONTAINMENT SYSTEMS
ECCS
Diesel Engines
Emergency diesel generator operating experience, 1981-1983, 11:11235 (R;US)
Materials
Disposal materials study, 11:11034 (R;US)
Quality Assurance
Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)
Valves
Aging and service wear of check valves used in engineered safety-feature systems of nuclear power plants. Volume 1. Operating experience and failure identification, 11:11273 (R;US)
ENGINEERING
See also HUMAN FACTORS ENGINEERING
Energy Models
Engineering/economic end-use energy models, 11:11375 (J;US)
ENGINES
For machines with self-contained energy sources; for machines utilizing external energy sources for normal operation see MOTORS.
See also ROCKET ENGINES
TURBOFAN ENGINES
Computerized Simulation
Piston engine for coal-water slurry fuel, 11:10883 (RA;US)
Performance
Piston engine for coal-water slurry fuel, 11:10883 (RA;US)
ENGLAND
See UNITED KINGDOM
ENRICHMENT (ISOTOPIC)
See ISOTOPE SEPARATION
ENRICHMENT PLANTS (CENTRIFUGE)
See CENTRIFUGE ENRICHMENT PLANTS
ENTRY CONTROL SYSTEMS
An activated barrier for protection of special nuclear materials in vital areas, 11:11102 (J;US)
ENVELOPE HOUSES
See DOUBLE ENVELOPE BUILDINGS

ENVIRONMENT
Mathematical Models
Monte Carlo calculations in environmental monitoring - applicability and limitations, 11:12520 (RA;AT)
ENVIRONMENTAL EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS
ENVIRONMENTAL TEMPERATURE
See AMBIENT TEMPERATURE
ENVIRONMENTAL TRANSPORT
See also LONG-RANGE TRANSPORT
RADIONUCLIDE MIGRATION
Mathematical Models
Comparison of a multilayer regional-scale acid rain assessment model (MLRAPT) with a single-layer assessment model, RAPT, 11:11872 (R;US)
EPIPHYSIS (BONES)
See BONE TISSUES
EPOXIDES
Electron Spin Resonance
ESR evidence for localized forms of C-C ring-opened oxirane radical cations, 11:11715 (J;US)
Photoacoustic Spectroscopy
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)
Radiolysis
ESR evidence for localized forms of C-C ring-opened oxirane radical cations, 11:11715 (J;US)
EPOXY COMPOUNDS
See EPOXIDES
EQUATIONS (DIFFERENTIAL)
See DIFFERENTIAL EQUATIONS
EQUILIBRIUM PLASMA
Three-Dimensional Calculations
Existence and calculation of sharp boundary MHD equilibrium in three-dimensional toroidal geometry, 11:12436 (R;US)
ERBIUM 158
Energy-Level Transitions
Slow and fast high-spin sequences in ^{158}Er, 11:12339 (J;US)
High Spin States
Slow and fast high-spin sequences in ^{158}Er, 11:12339 (J;US)
Yrast States
Slow and fast high-spin sequences in ^{158}Er, 11:12339 (J;US)
ERBIUM 165
Energy Levels
Nonrotational states in ^{165}Er, 11:12336 (R;SU;In Russian)
ERBIUM ALLOYS
Magnetic Specific Heat
Calorimetric investigation of the Y-Er magnetic phase diagram, 11:11505 (R;FR)
ERGONOMICS
See HUMAN FACTORS ENGINEERING
EROSION
Mitigation
Protection of uranium tailings impoundments against overland erosion, 11:11026 (R;US)
ERYTHROPOIETIN
Bioassay
Correlation between bioassay and radioimmunoassay for erythropoietin in human serum and urine concentrates, 11:11949 (J;US)
Radioimmunoassay
Correlation between bioassay and radioimmunoassay for erythropoietin in human serum and urine concentrates, 11:11949 (J;US)
ESCHERICHIA COLI
Delayed Radiation Effects
Recovery of aerobic and anaerobic bacteria from irradiated mice, 11:11990 (R;US)
Genetic Engineering
[Templates, site specifically modified with carcinogens]. Final report, 11:11947 (R;US)
ESTERASES
Code number 3.1.
Molecular Structure
Fungal penetration of defensive barriers of plants, 11:11933 (RA;US)
ESTUARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
ETA MESONS
Radiative Decay
JADE: search for new particles and tests of Standard Model, 11:12146 (RA;US)
ETA-549
See ETA MESONS
ETHANAL
See ACETALDEHYDE
ETHANE
Chemical Reactions
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)
Photoacoustic Spectroscopy
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)
Retention
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
Solvent Properties
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
Viscosity
Thermophysical properties correlations and pseudocomponent characterization parameter estimation for fossil fluids. First quarterly report (III year), September 1-November 30, 1985, 11:11674 (R;US)
ETHANOL
Adsorption Heat
Characterization of coal surfaces. Technical progress report, August 21-November 20, 1985, 11:10856 (R;US)
Chemical Reaction Yield
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)
Energy Policy
Fermentation ethanol can be a partial solution to the energy crisis, 11:11135 (RA;PR)
Energy Source Development
Fermentation ethanol can be a partial solution to the energy crisis, 11:11135 (RA;PR)
Fuel Substitution
Fermentation ethanol can be a partial solution to the energy crisis, 11:11135 (RA;PR)
Phase Diagrams
Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)
Photochemical Reactions
Assessment of photochemical applications to specific stages in Savannah River Plant actinide reprocessing streams, 11:10988 (R;US)
Production
Conversion of food processing wastes into ethanol using a novel biological reactor/separator. Final report, September 1, 1984-September 30, 1985, 11:11139 (R;US)
Food crop versus energy-crop production in the Caribbean, 11:11138 (RA;PR)
Use of appropriate technologies for biomass waste conversion in small communities, 11:11126 (RA;PR)
Resource Potential
Alcohols and ideas for savings of petroleum crude at local refineries in the Caribbeans, 11:11136 (RA;PR)
Synthesis
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)
Thermodynamic Activity
Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)
ETHANOL FUELS
Use for pure ethanol, ethanol-water mixtures, or ethanol with additives; for ethanol-gasoline mixtures, use GASOHOL.

Energy Policy
Fermentation ethanol can be a partial solution to the energy crisis, 11:11135 (RA;PR)
Energy Source Development
Fermentation ethanol can be a partial solution to the energy crisis, 11:11135 (RA;PR)
Fuel Substitution
Fermentation ethanol can be a partial solution to the energy crisis, 11:11135 (RA;PR)
Production
Full-scale continuous fermentation for the commercial production of fuel ethanol, 11:11137 (RA;PR)
Recombinant genetic approaches for efficient ethanol production, 11:11145 (BA;US)

ETHANOL PLANTS
Commercialization
Full-scale continuous fermentation for the commercial production of fuel ethanol, 11:11137 (RA;PR)
Technology Assessment
Full-scale continuous fermentation for the commercial production of fuel ethanol, 11:11137 (RA;PR)

ETHINE
See ACETYLENE

ETHNIC GROUPS
See MINORITY GROUPS

ETHOCEL
See CELLULOSE

ETHYL ALCOHOL
See ETHANOL

ETHYL RADICALS
Chemical Preparation
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)

ETHYLALDEHYDE
See ACETALDEHYDE

ETHYLENE
Adsorption
Observation of isolated carbon atoms and the study of their mobility on Pt clusters by NMR, 11:11534 (J;US)
Structure and reactions of C_2H_4 adsorbed on small Pt clusters, 11:11684 (J;US)
Chemical Reactions
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)
Fabry-Perot Interferometer
Trace detection in gases using photoacoustic spectroscopy and Fabry-Perot interferometry, 11:11637 (D;US)
Photoacoustic Spectroscopy
Trace detection in gases using photoacoustic spectroscopy and Fabry-Perot interferometry, 11:11637 (D;US)
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)

ETHYLENECARBOXYLIC ACID
See ACRYLIC ACID

ETHYNE
See ACETYLENE

EUROPEAN COMMUNITIES
Reactor Decommissioning
Community's research and development programme on decommissioning of nuclear power plants. Fourth annual progress report (year 1983), 11:11227 (R;LU)

EUROPIUM COMPOUNDS
Mass Spectroscopy
Mass spectrometry of inductively coupled plasmas, 11:11624 (J;US)

EVALUATED NUCLEAR DATA FILE
See NUCLEAR DATA COLLECTIONS

EVAPORATORS
Computerized Control Systems
Controlling a cooling medium evaporator with an electrically-driven injection valve, 11:11465 (RA;DE;In German)

EXCHANGE (CHARGE)
See CHARGE EXCHANGE

EXCHANGE (HEAT)
See HEAT TRANSFER

EXCITED STATES
See also METASTABLE STATES
Magnetic Moments
Magnetic moments of excited states in nuclei far from stability, 11:12327 (R;US)

EXCLUSIVE INTERACTIONS
Quantum Chromodynamics
Evolution kernels in QCD: two-loop calculation in the Feynman gauge, 11:12249 (R;SU;In Russian)

EXCRETION ANALYSIS
See PERSONNEL MONITORING

EXOTIC ATOMS
See HADRONIC ATOMS

EXPERIMENTAL BREEDER REACTOR-2
See EBR-2 REACTOR

EXPOSURE CHAMBERS
Design
Biological studies of swine exposed to 60-Hz electric fields. Volume 3. Exposure system and dosimetry. Final report, 11:12019 (R;US)
Two-dimensional diffusion limited system for cell growth, 11:11985 (R;US)
Evaluation
Biological studies of swine exposed to 60-Hz electric fields. Volume 3. Exposure system and dosimetry. Final report, 11:12019 (R;US)

EXPOSURE (RADIATION DOSES)
See RADIATION DOSES

EXTRACTION (SOLVENT)
See SOLVENT EXTRACTION

EXTREMELY HIGH FREQUENCY RADIATION
See MICROWAVE RADIATION

EXXON DONOR SOLVENT LIQUEFACTION
See EXXON LIQUEFACTION PROCESS

EXXON GASIFICATION PROCESS
Catalysts
Catalytic Coal Gasification Process Development Unit operation, 11:10737 (RA;US)
Chemical Reactions
Catalytic Coal Gasification Process Development Unit operation, 11:10737 (RA;US)
Deposits
Catalytic Coal Gasification Process Development Unit operation, 11:10737 (RA;US)
Flowsheets
Catalytic Coal Gasification Process Development Unit operation, 11:10737 (RA;US)
Process Development Units
Catalytic Coal Gasification Process Development Unit operation, 11:10737 (RA;US)

EXXON LIQUEFACTION PROCESS
Chemical Effluents
Comparative biology and chemistry of boiling point fractions from different coal liquefaction processes, 11:10927 (R;US)
Organic Solvents
EDS Coal Liquefaction Process Development. Phase V. Quarterly technical progress report, July 1-September 30, 1985, 11:10920 (R;US)

F

FACE CENTERED CUBIC
See FCC LATTICES

FACILITIES (ENERGY)
See ENERGY FACILITIES

FACILITIES (MAINTENANCE)
See MAINTENANCE FACILITIES

FACILITIES (MILITARY)
See MILITARY FACILITIES

FACILITIES (NUCLEAR)
See NUCLEAR FACILITIES

FACILITIES (RESOURCE RECOVERY)
See RESOURCE RECOVERY FACILITIES

FACILITIES (STORAGE)
See STORAGE FACILITIES
FARADAY GENERATORS
See MHD GENERATORS
FARMS
Systems Analysis
Energy-integrated farm plan for Puerto Rico, 11:11128 (RA;PR)
Waste Management
Energy-integrated farm plan for Puerto Rico, 11:11128 (RA;PR)
FAST FLUX TEST FACILITY REACTOR
See FFTF REACTOR
FASTBUS SYSTEM
Architecture
FASTBUS data acquisition system for neutron time-of-flight measurements, 11:12387 (J;US)
FATTY ACIDS
See CARBOXYLIC ACIDS
FAULT TREE ANALYSIS
Computer Calculations
Computer-aided reliability analysis of complex systems, 11:11253 (RA;CS;In Czech)
FAULT TREE SYSTEMS
See FAULT TREE ANALYSIS
FCC LATTICES
Free Energy
Free energy difference calculations comparing fcc and hcp structures using molecular dynamics computer simulations, 11:12398 (J;US)
Stability
Free energy difference calculations comparing fcc and hcp structures using molecular dynamics computer simulations, 11:12398 (J;US)
FEDERAL BUILDINGS
Energy Management
Ten-Year Inhouse Energy Management Plan, 11:11444 (R;US)
FEDERAL DRIVING CYCLE
See FEDERAL TEST PROCEDURE
FEDERAL ENERGY REGULATORY COMMISSION
See US FERC
FEDERAL REPUBLIC OF GERMANY
Coal Deposits
Utilization of non-mineable coal - a new approach of German coal industry, 11:10743 (RA;US)
Coal Reserves
Utilization of non-mineable coal - a new approach of German coal industry, 11:10743 (RA;US)
Reactor Licensing
Role of experts in the safety and reliability of nuclear installations. Analysis of situation in the Federal Republic of Germany, 11:11316 (RA;CS;In German)
Reactor Safety
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
FEDERAL TEST PROCEDURE
Characterization of exhaust emissions from alcohol-fueled vehicles. Final report, 11:11498 (R;US)
FEED MATERIALS PRODUCTION CENTER
Material Balance
The results of the NLO error propagation exercise, 11:11099 (J;US)
Nuclear Materials Management
The results of the NLO error propagation exercise, 11:11099 (J;US)
FERMENTATION ALCOHOL
See ETHANOL
FERMI BETA THEORY
See FERMI INTERACTIONS
FERMI CONSTANTS
See FERMI INTERACTIONS
FERMI INTERACTIONS
Wave Equations
Relativistic wave equations for two interacting particles and zero mass bound states, 11:12192 (R;FR)
FERMI PSEUDOPOTENTIAL
See FERMI INTERACTIONS
FERMILAB ACCELERATOR
Facility at Fermi National Accelerator Laboratory, Batavia, Illinois, includes main synchroton, booster synchrotron, and linac.
Radiation Detectors
Operational approach to high energy physics detectors at Fermilab, 11:12155 (R;US)
FERMIONS
See also BARYONS
LEPTONS
Charge State
Induced charges and tunneling in soliton-antisoliton systems, 11:12260 (J;US)
Invariance Principles
Fermions in the space-time R x S^3, 11:12414 (J;US)
Lagrangian Function
Fermions in the space-time R x S^3, 11:12414 (J;US)
Propagator
Fermions in the space-time R x S^3, 11:12414 (J;US)
Wave Functions
Fermions in the space-time R x S^3, 11:12414 (J;US)
FERMI-WEIZSAECKER FORMULA
See FERMI INTERACTIONS
FERRITIC STEELS
Lifetime
Effects of irradiation and high heat flux on the lifetime performance of ferritic and 316 stainless steels, 11:11530 (R;US)
Mechanical Properties
Effects of irradiation and high heat flux on the lifetime performance of ferritic and 316 stainless steels, 11:11530 (R;US)
Performance Testing
Effects of irradiation and high heat flux on the lifetime performance of ferritic and 316 stainless steels, 11:11530 (R;US)
Sulfidation
Effect of sulfur sorbent and gas cycling on corrosion of FBC materials at 866 K, 11:10896 (R;US)
FERROMAGNETIC MATERIALS
Penetration Depth
Magnetic depth profiles by neutron reflection, 11:11508 (R;US)
FERROMAGNETISM
Correlations
Potts ferromagnet correlation length in hypercubic lattices: Renormalization - group approach, 11:12395 (R;BR)
FERTILE MATERIALS
Isotope Ratio
Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel, 11:11108 (J;US)
FETUSES
Genetic Radiation Effects
Chromosome investigations on persons whose mothers have been treated with ionizing radiations during pregnancy, 11:11995 (R;DE;In German)
FFTF REACTOR
Westinghouse Hanford Company, Richland, Washington
Fuel Pins
TS-1 and TS-2 transient overpower tests on FFTF fuel, 11:11315 (R;US)
Transient Overpower Accidents
TS-1 and TS-2 transient overpower tests on FFTF fuel, 11:11315 (R;US)
FIBROBLASTS
Metabolism
Carcinogenic potential of products produced by coal conversion processes. Final technical report, 11:11966 (R;US)
Radiometric Analysis
Radiometric methods for rapid diagnosis of viral infection. Annual report, 1 February 1976-31 January 1977, 11:11984 (R;US)
FIELDS (ELECTRIC)
See ELECTRIC FIELDS

FIELDS (MAGNETIC)
See MAGNETIC FIELDS
FILMS
Not for PHOTOGRAPHIC FILMS or NUCLEAR EMULSIONS.
See also THIN FILMS
Crystal Structure
Infrared spectra and structure of thin films of solid oxygen, 11:11655 (J;US)
Infrared Spectra
Infrared spectra and structure of thin films of solid oxygen, 11:11655 (J;US)
Shear
Method and apparatus for measuring shear modulus and viscosity of a monomolecular film, 11:11766 (P;US)
Two-Phase Flow
Method and apparatus for measuring shear modulus and viscosity of a monomolecular film, 11:11766 (P;US)
Viscosity
Method and apparatus for measuring shear modulus and viscosity of a monomolecular film, 11:11766 (P;US)
FILTERS
Materials
Ceramic filter elements for high-pressure, high-temperature gases, 11:11222 (R;US)
Performance Testing
Ceramic filter elements for high-pressure, high-temperature gases, 11:11222 (R;US)
Permeability
Ceramic filter elements for high-pressure, high-temperature gases, 11:11222 (R;US)
FINANCIAL MANAGMENT
See PROGRAM MANAGEMENT
FINGERPRINTING (OIL SPILLS)
See OIL SPILLS
FIRE PREVENTION
Safety Engineering
Basis for safety standards aimed at averting fire and explosion hazards during work involving hydrogen, 11:11739 (RA;XA)
FIRE STATIONS
See PUBLIC BUILDINGS
FIREDAMP
See METHANE
FIREWOOD
See WOOD FUELS
FIRST WALL
Crack Propagation
Effects of radiation and high heat flux on the performance of first-wall components. Final report, 11:12491 (R;US)
Review of failure criteria for thin wall structures in a high heat flux environment, 11:12508 (R;US)
Eddy Currents
Eddy currents in a nonperiodic vacuum vessel induced by axisymmetric plasma motion, 11:12500 (R;US)
Hydrogen Embrittlement
Effects of radiation and high heat flux on the performance of first-wall components. Final report, 11:12491 (R;US)
Infrared Thermography
Infrared thermography of first wall components on TMX-U, 11:12501 (R;US)
Physical Radiation Effects
Effects of radiation and high heat flux on the performance of first-wall components. Final report, 11:12491 (R;US)
Thermal Fatigue
Effects of radiation and high heat flux on the performance of first-wall components. Final report, 11:12491 (R;US)
FISCHER-TROPSCH SYNTHESIS
Catalysts
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985, 11:11142 (R;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
Chemical Reactors
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985, 11:11142 (R;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Fluid Mechanics
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
FISHES
Ecology
Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic). Mummichog and striped killifish (Fundulus heteroclitus; Fundulus majalis), 11:11911 (R;US)
FISSILE MATERIALS
Isotope Ratio
Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel, 11:11108 (J;US)
FISSION PRODUCT RELEASE
Coordinate with descriptors for the area of release such as BIOSPHERE or COOLANTS, and for the specific fission products, if known.
Mathematical Models
Aerosol generation by liquid breakup resulting from sparging of molten pools of corium by gases released during core/concrete interactions, 11:11355 (J;US)
FISSION PRODUCTS
Data Acquisition Systems
Report on CFRMF fission product loop study, 11:12329 (R;US)
Decay
Report on CFRMF fission product loop study, 11:12329 (R;US)
Ground Disposal
Ground disposal of radioactive wastes at the Hanford site, 11:11901 (R;US)
Ion Exchange Chromatography
Separation and purification of fission products from process streams of irradiated nuclear fuel, 11:11022 (RA;XA)
FISSIONABLE MATERIALS MANAGEMENT
See NUCLEAR MATERIALS MANAGEMENT
FIXED BED
See PACKED BED
FLAME PROPAGATION
Velocity
Fundamentals of coal dust combustion: recommendations for research on explosive limits of coal dust, 11:10897 (RA;US)
FLAME TEMPERATURE
See COMBUSTION PROPERTIES
FLAMES
Chemical Reaction Kinetics
Effect of in-situ heat treatment on coal char reactivity. Engineering kinetics of coal pyrolysis and combustion in normal and high intensity flames. Progress report, 11:10908 (R;US)
Raman Spectroscopy
Simultaneous multipoint measurements of density gradients and temperature in a flame. Final report, July 1, 1981-July 31, 1985, 11:12128 (R;US)
FLASH POINT
See COMBUSTION PROPERTIES
FLOORS
Response Functions
Reliability evaluation of containments including soil-structure interaction, 11:11332 (R;US)
FLORIDA
Acid Rain
Effects of acid precipitation on a typical quartzipsamment soil in Florida, 11:11896 (R;US)
Coal Preparation Plants
CoaLiquid, Inc. coal slurry fuels commercial program - 1985, 11:10843 (RA;US)

FLORIDA UNIVERSITY REACTOR
See UFTR REACTOR
FLOTATION
Bubbles
Advanced physical fine coal cleaning microbubble flotation. Topical report No. 1. GHH-Bergbau Forschung microbubble coal flotation machine, 11:10857 (R;US)
FLOWERS
Use only for plant structures involved in sexual reproductive processes.
Plant Growth
Control of cell wall formation in pollen tubes: the interaction of dictyosome activity with the rate of tip extension, 11:11962 (RA;US)
FLUE GAS
Denitrification
Alternative method for the removal of oxides of nitrogen and sulfur from combustion processes. First quarterly technical status report, September 17-December 31, 1985, 11:10788 (R;US)
Desulfurization
Alternative method for the removal of oxides of nitrogen and sulfur from combustion processes. First quarterly technical status report, September 17-December 31, 1985, 11:10788 (R;US)
Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas, 11:10802 (RA;US)
Conventional coal cleaning of high-ash low-rank coals, 11:10852 (RA;US)
Environmental control technology, 11:11219 (RA;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
FLUIDIZED BED
See FLUIDIZED BEDS
FLUIDIZED BED BOILERS
Combustion Products
Ceramic filter elements for high-pressure, high-temperature gases, 11:11222 (R;US)
FLUIDIZED BEDS
Density
Catalytic Coal Gasification Process Development Unit operation, 11:10737 (RA;US)
FLUIDIZED-BED COMBUSTION
Meetings
Preparation, handling, and storage, 11:10851 (RA;US)
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Research Programs
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Test Facilities
Fluid bed combustion bed properties with LRC, 11:10902 (RA;US)
Technical and economic aspects of a lignite-fired AFBC boiler, 11:10901 (RA;US)
FLUIDIZED-BED COMBUSTORS
Air Pollution
Fluidized bed combustion of coal-water slurry, 11:10879 (RA;US)
Cogeneration
Investigation of fluid-bed combustion of municipal solid waste, 11:11483 (R;US)
Combustion Products
Hot gas cleanup for pressurized fluidized bed combustion burning low rank coal, 11:10903 (RA;US)
Design
Fluidized bed combustion, 11:10900 (RA;US)
Technical and economic aspects of a lignite-fired AFBC boiler, 11:10901 (RA;US)
Desulfurization
Fluidized bed combustion of coal-water slurry, 11:10879 (RA;US)
Economics
Technical and economic aspects of a lignite-fired AFBC boiler, 11:10901 (RA;US)
Efficiency
Fluidized bed combustion of coal-water slurry, 11:10879 (RA;US)
Investigation of fluid-bed combustion of municipal solid waste, 11:11483 (R;US)
Materials Testing
Effect of sulfur sorbent and gas cycling on corrosion of FBC materials at 866 K, 11:10896 (R;US)
Performance
Fluidized bed combustion of coal-water slurry, 11:10879 (RA;US)
Technology Assessment
Technical and economic aspects of a lignite-fired AFBC boiler, 11:10901 (RA;US)
FLUORANTHENE
See CONDENSED AROMATICS
FLUORENE
Chemical Reaction Yield
Determination of radical initiating and hydrogen donating properties of coal liquefaction process solvents by reaction with fluorenone, 11:10792 (R;US)
FLUORIDES
See also LITHIUM FLUORIDES
URANYL FLUORIDES
Biological Accumulation
Fluoride emissions of coal-fired power plants and their impact upon plant and animal species, 11:10812 (J;US)
Ecological Concentration
Fluoride emissions of coal-fired power plants and their impact upon plant and animal species, 11:10812 (J;US)
FLUORINATED ALIPHATIC HYDROCARBONS
Density
Theoretical and experimental study of the equation of state of tetrafluoromethane, 11:11677 (J;US)
Vaporization Heat
Theoretical and experimental study of the equation of state of tetrafluoromethane, 11:11677 (J;US)
FLUORINATED AROMATIC HYDROCARBONS
Labelling
Fluorination of aromatic compounds with F_2 and acetyl hypofluorite. Synthesis of ^{18}F-aryl fluorides by cleavage of aryl-tin bonds, 11:11724 (R;CA)
Mechanism of tritium-atom promoted isotope exchange in the benzene ring. 2. Substituent effects and a crossover in labelling mechanism, 11:11693 (J;US)
Survey of the cleavage of aryl-metal bonds by elemental fluorine. Synthesis of aryl-fluorides, 11:11723 (R;CA)
FLUORINE
X-Ray Spectra
Systematics of K X-ray satellite structure excited by heavy-ion impact, 11:12075 (RA;US)
FLUORINE 18
Radiochemistry
Fluorination of aromatic compounds with F_2 and acetyl hypofluorite. Synthesis of ^{18}F-aryl fluorides by cleavage of aryl-tin bonds, 11:11724 (R;CA)
Survey of the cleavage of aryl-metal bonds by elemental fluorine. Synthesis of aryl-fluorides, 11:11723 (R;CA)
FLUORINE FLUORIDES
See FLUORINE
FLUORINE IONS
Ion-Atom Collisions
Time dependent Hartree-Fock theory of ion-atom collisions: Application to F^{9+} /Ne, 11:12103 (J;NL)
FLY ASH
Chemical Composition
Aerosol formation from pulverized coal combustion. Quarterly report No. 9, 11:11734 (R;US)
Size and composition of particulate emissions from the combustion of coal slurries, 11:10807 (RA;US)
Leaching
Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas, 11:10802 (RA;US)

Particle Size
Size and composition of particulate emissions from the combustion of coal slurries, 11:10807 (RA;US)
Processing
Potential resources from coal fly ash, 11:10806 (J;US)
Waste Disposal
Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas, 11:10802 (RA;US)
Environmental control technology, 11:11219 (RA;US)
Waste Product Utilization
Environmental control technology, 11:11219 (RA;US)

FLYWHEELS
Design
Matched metal die compression molded structural random fiber fiber sheet molding compound flywheel, 11:11495 (P;US)
Molding
Matched metal die compression molded structural random fiber fiber sheet molding compound flywheel, 11:11495 (P;US)

FOAMS
Drying
Renovation of DOT specification 21PF-1 protective shipping packages, 11:11746 (R;US)

FOCK METHOD
See HARTREE-FOCK METHOD

FOCK SELF-CONSISTENT FIELD
See HARTREE-FOCK METHOD

FOG (SPRAYS)
See SPRAYS

FOKKER-PLANCK COEFFICIENTS
See FOKKER-PLANCK EQUATION

FOKKER-PLANCK EQUATION
Analytical Solution
[Glass Development Laser (GDL) Facility upgrade.] LLE Review. Quarterly report, October-December 1984. Volume 21, 11:12487 (R;US)
Numerical Solution
Discretization methods for one-dimensional Fokker-Planck operators, 11:12423 (J;US)
Fokker-Planck and quasilinear codes, 11:12453 (R;US)

FOOD
See also ANIMAL FEEDS
BEVERAGES
MEAT
MILK
VEGETABLES
Cold Storage
Round-table discussion: -18°C in the food industry, 11:11469 (RA;DE;In German)
Comparative Evaluations
Refrigerated foods in bulk containers - influence of the way processing is done on the microbiological stability of instant dishes, 11:11467 (RA;DE;In German)
Cooling
Evaporators, expansion chambers and defrosting processes for industrial refrigerators, 11:11427 (RA;DE;In German)
Freezing
Evaporators, expansion chambers and defrosting processes for industrial refrigerators, 11:11427 (RA;DE;In German)
Irradiation as a process in competition with deep-freezing, 11:11116 (RA;DE;In German)
Preservation
Cold: An important factor in the food industry, 11:11428 (RA;DE;In German)
Production
Food crop versus energy-crop production in the Caribbean, 11:11138 (RA;PR)
Quality Assurance
Cold: An important factor in the food industry, 11:11428 (RA;DE;In German)
Radiopreservation
Irradiation as a process in competition with deep-freezing, 11:11116 (RA;DE;In German)
Refrigeration
Refrigerated foods in bulk containers - influence of the way processing is done on the microbiological stability of instant dishes, 11:11467 (RA;DE;In German)

FOOD AND DRUG ADMINISTRATION
See US FDA

FOOD CHAINS
Mathematical Models
Comparison of predictions from internationally recognized assessment models for the transfer of selected radionuclides through terrestrial food chains, 11:11904 (J;US)

FOOD INDUSTRY
Dryers
Solar and energy-conserving food technologies: a training manual, 11:11195 (R;US)
Energy Conservation
Solar and energy-conserving food technologies: a training manual, 11:11195 (R;US)
Refrigerating Machinery
Screw compressors in the food industry, 11:11464 (RA;DE;In German)
Refrigeration
Use of ice storage equipment in the food industry, 11:11466 (RA;DE;In German)
Refrigerators
Cold: An important factor in the food industry, 11:11428 (RA;DE;In German)

FOOD IRRADIATION
See FOOD PROCESSING

FOOD PROCESSING
Quality Assurance
Refrigerated foods in bulk containers - influence of the way processing is done on the microbiological stability of instant dishes, 11:11467 (RA;DE;In German)

FOODSTUFFS
See FOOD

FORESTS
Carbon Cycle
Coupling of carbon, water, and nutrient interactions in woody plant soil systems. Program and presentation summaries, 11:11162 (R;US)
Ecological Succession
Linkages in hierarchical models, 11:11893 (R;US)
Emission
Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)
Mineral Cycling
Coupling of carbon, water, and nutrient interactions in woody plant soil systems. Program and presentation summaries, 11:11162 (R;US)
Nitrogen Cycle
Coupling of carbon, water, and nutrient interactions in woody plant soil systems. Program and presentation summaries, 11:11162 (R;US)

FORMALDEHYDE
Pollution Sources
Formaldehyde emissions from fibrous glass insulation products, 11:11865 (R;US)
Rotational States
Variational calculations of rotational-vibrational energy levels of formaldehyde X $^1A_1$, 11:11681 (J;US)
Vibrational States
Variational calculations of rotational-vibrational energy levels of formaldehyde X $^1A_1$, 11:11681 (J;US)

FORMALIN
See FORMALDEHYDE

FORMALITH
See FORMALDEHYDE

FORMATES
Piezometry
Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)

FORMATION PRESSURE
See RESERVOIR PRESSURE

FORMIC ACID
Metabolism
One carbon metabolism in anaerobic bacteria: organic acid and methane production. Final technical report, 11:11129 (R;US)
FORMIC ALDEHYDE
See FORMALDEHYDE
FORMING (MATERIALS)
See MATERIALS WORKING
FORMOL
See FORMALDEHYDE
FOSSIL FUEL RESERVES
See FOSSIL FUELS
FOSSIL FUELS
See also COAL
NATURAL GAS
OIL SHALES
PEAT
PETROLEUM
SHALE OIL
Research Programs
Fiscal year 1986 Department of Energy authorization (fossil energy). Volume 1. Hearing before the Subcommittee on Energy Development and Applications of the Committee on Science and Technology, US House of Representatives, Ninety-Ninth Congress, First Session, March 6, 1985, 11:11386 (B;US)
FOSSIL-FUEL POWER PLANTS
Boilers
Retrofit considerations for adding coal-water-mixture fuel capability at Houston Lighting and Power's Sam Bertron Plant, 11:10894 (RA;US)
Dry Scrubbers
Environmental control technology, 11:11219 (RA;US)
Modeling of spray dryer desulfurization, 11:11220 (RA;US)
Environmental Effects
Fluoride emissions of coal-fired power plants and their impact upon plant and animal species, 11:10812 (J;US)
Flue Gas
Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas, 11:10802 (RA;US)
Environmental control technology, 11:11219 (RA;US)
Fly Ash
Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas, 11:10802 (RA;US)
Potential resources from coal fly ash, 11:10806 (J;US)
Fuel Substitution
Cape Breton Development Corporation's CARBOGEL coal water fuel project, 11:10845 (RA;US)
Retrofit considerations for adding coal-water-mixture fuel capability at Houston Lighting and Power's Sam Bertron Plant, 11:10894 (RA;US)
Information Systems
Reliability information system for conventional and nuclear power plants, 11:11217 (RA;CS;In Czech)
Materials Recovery
Potential resources from coal fly ash, 11:10806 (J;US)
Meetings
Reliability of fossil-fuel and nuclear power installations, 11:11243 (R;CS;In Czech, Slovak, German and Russian)
Modifications
Retrofit considerations for adding coal-water-mixture fuel capability at Houston Lighting and Power's Sam Bertron Plant, 11:10894 (RA;US)
Reliability
Optimization of reliability and quality of power sources in power systems, 11:11244 (RA;CS;In Russian)
Reliability of fossil-fuel and nuclear power installations, 11:11243 (R;CS;In Czech, Slovak, German and Russian)
Reliability information system for conventional and nuclear power plants, 11:11217 (RA;CS;In Czech)
Utilization of conventional and nuclear power plant reliability information systems, 11:11216 (RA;CS;In Czech)
Scrubbers
Environmental control technology, 11:11219 (RA;US)
Water Treatment
Life and reliability of water treatment equipment manufactured by CKD Dukla for fossil-fuel and nuclear power plants, 11:11246 (RA;CS;In Czech)
FOUR-FERMION INTERACTION
See FERMI INTERACTIONS
FOXES
Blood Count
Hematologic values of the endangered San Joaquin kit fox, Vulpes macrotis mutica, 11:10937 (R;US)
FRAGMENTS (DECAY)
See DECAY
FRANCE
Coal Gasification
UCG tests at la Haute-Deule - first results, 11:10747 (RA;US)
FREE ELECTRON LASERS
Beam Optics
Injector modeling and achievement/maintenance of high brightness, 11:12504 (R;US)
Design
Injector modeling and achievement/maintenance of high brightness, 11:12504 (R;US)
Instability
Kinetic description of harmonic instabilities in a planar wiggler free-electron laser, 11:11759 (J;US)
Mathematical Models
Squeezing and antibunching in a one electron FEL model, 11:12402 (R;IT)
Meetings
7th international free electron laser conference. Abstracts, 11:11755 (R;US)
Research Programs
7th international free electron laser conference. Abstracts, 11:11755 (R;US)
FREE RADICALS
See RADICALS
FREEZERS
Compressors
Rapid freezing equipment with two-level screw compressor system, 11:11429 (RA;DE;In German)
Design
Rapid freezing equipment with two-level screw compressor system, 11:11429 (RA;DE;In German)
Performance
Evaporators, expansion chambers and defrosting processes for industrial refrigerators, 11:11427 (RA;DE;In German)
FRESH WATER
Environmental Transport
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, 1 Dec 1984-30 November 1985, 11:11905 (R;US)
Quantitative Chemical Analysis
Extraction of arsenic(III) and arsenic(V) from natural waters for neutron activation analysis, 11:11626 (J;US)
FRESH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS
FRICTIONLESS FLOW
See IDEAL FLOW
FTR REACTOR (RICHLAND)
See FFTF REACTOR
FUEL ASSEMBLIES
See also FUEL ELEMENT CLUSTERS
Heat Transfer
Trends in thermal calculations for light water reactor fuel (1971-1981), 11:11238 (R;US)
Hydraulics
Trends in thermal calculations for light water reactor fuel (1971-1981), 11:11238 (R;US)
FUEL BUNDLES
See FUEL ELEMENT CLUSTERS
FUEL CELL POWER PLANTS
For commercial, residential, or electric utility use.
Comparative Evaluations
Fuel cell power plant designs: a review, 11:11408 (R;US)

Construction
Onsite 40-kilowatt fuel cell power plant manufacturing and field test program, 11:11409 (R;US)
Design
Fuel cell power plant designs: a review, 11:11408 (R;US)
FUEL CELLS
Marketing Research
Potential application of fuel cells in the chlor-alkali industry, 11:11410 (R;US)
Uses
Potential application of fuel cells in the chlor-alkali industry, 11:11410 (R;US)
FUEL CONSUMPTION
Statistical Data
Motor Fuel Consumption model. Twelfth periodical report, 11:11461 (R;US)
FUEL COOLING INSTALLATIONS
See SPENT FUEL STORAGE
FUEL CYCLE
Accidents
Calculational methods for analysis of postulated UF_6 releases. Volume 2, 11:11078 (R;US)
FUEL ELEMENT CLUSTERS
Heat Transfer
MELPROG analysis of the DF-1 severe core damage experiment, 11:11352 (R;US)
Hydraulics
MELPROG analysis of the DF-1 severe core damage experiment, 11:11352 (R;US)
FUEL FABRICATION PLANTS
Alarm Systems
Resolving MC & A alarms from process monitoring in a fuel fabrication facility, 11:11090 (J;US)
Losses
Resolving MC & A alarms from process monitoring in a fuel fabrication facility, 11:11090 (J;US)
Nuclear Materials Management
Resolving MC & A alarms from process monitoring in a fuel fabrication facility, 11:11090 (J;US)
Process Control
Resolving MC & A alarms from process monitoring in a fuel fabrication facility, 11:11090 (J;US)
FUEL FEEDING SYSTEMS
Engineering
Design considerations for coal-water slurry handling systems at utility and industrial plants, 11:10835 (RA;US)
FUEL GAS
See also HIGH BTU GAS
NATURAL GAS
Chemical Composition
Fuel cell power plant designs: a review, 11:11408 (R;US)
Cost
Critical economic parameters for underground coal gasification, 11:10916 (RA;US)
Marketing Research
Critical economic parameters for underground coal gasification, 11:10916 (RA;US)
FUEL OILS
See also HEATING OILS
RESIDUAL FUELS
Carcinogen Screening
EDS Coal Liquefaction Process Development. Phase V. Quarterly technical progress report, July 1-September 30, 1985, 11:10920 (R;US)
Combustion
Size and composition of particulate emissions from the combustion of coal slurries, 11:10807 (RA;US)
Toxicity
EDS Coal Liquefaction Process Development. Phase V. Quarterly technical progress report, July 1-September 30, 1985, 11:10920 (R;US)
FUEL PELLETS
Design
LLE Review. Quarterly report, April-June 1985, 11:12488 (R;US)
FUEL PENCILS
See FUEL PINS
FUEL PINS
Deformation
"CAMERA" test facility in the OSIRIS reactor. Diametral measurement device under flux of PWR fuel pins, 11:11275 (R;FR;In French)
Swelling
Advanced-fuel performance model Euges-Aries. Description and listing of the computer program and introduction to its use, 11:11258 (R;DE)
FUEL REPROCESSING
See REPROCESSING
FUEL REPROCESSING PLANTS
Neutron Monitors
Calibration of an NDA neutron monitor for determining process holdup, 11:11087 (J;US)
Off-Gas Systems
Application of silver-free zeolites to remove iodine from dissolver off-gases in spent fuel reprocessing plants, 11:11021 (RA;XA)
Pilot Plants
Five years experience of pulse columns extraction cycles for the reprocessing of fast breeder reactor fuels at the Marcoule pilot plant (SAP), 11:10987 (R;FR)
FUEL RODS
Fuel-Cladding Interactions
Fuel Performance Improvement Program. Progress report, April 1984-March 1985, 11:11232 (R;US)
Performance Testing
Fuel Performance Improvement Program. Progress report, April 1984-March 1985, 11:11232 (R;US)
FUEL SLUGS
See FUEL RODS
FUEL SLURRIES
Atomization
Atomization of coal water mixtures, 11:10865 (RA;US)
Coal water slurry barge delivery to Boston Edison Mystic 4 for a demonstration test burn, 11:10849 (RA;US)
Correlation of the spray characteristics of coal-water-fuels, 11:10863 (RA;US)
Droplet size distribution changes during the atomization of a coal water slurry, 11:10864 (RA;US)
Effect of fuel formulation on the atomization characteristics of coal-water mixtures, 11:10867 (RA;US)
Experience with the NRC burner assembly, 11:10881 (RA;US)
Photographic and Malvern analysis of coal-water slurry atomization, 11:10866 (RA;US)
Chemical Analysis
Characterization and combustion of low-rank coal-water slurries, 11:10794 (RA;US)
Cocombustion
Coal-water mixture firing in an industrial package boiler: a user's perspective, 11:10887 (RA;US)
Combustion
Achieving high combustion efficiency burning coal-water fuels, 11:10862 (RA;US)
Advance of SSCT's CWF project in China (State Science and Technology Commission; coal water fuel), 11:10833 (RA;US)
Characterization and combustion of low-rank coal-water slurries, 11:10794 (RA;US)
Coal-water-fuel firing experience at Chatham #2, 11:10890 (RA;US)
Coal-water fuel developments in eastern Canada: the Chatham and Charlottetown demonstrations and beyond, 11:10891 (RA;US)
Combustion trials on coal water slurry and petroleum coke water slurry, 11:10872 (RA;US)
Combustion of coal water slurry in a gas turbine combustor, 11:10882 (RA;US)
Combustion tests of beneficiated and micronized coal-water fuels: use of internal-mix atomizer and rotary-cup burner, 11:10886 (RA;US)
Comparison of the performance of a cross-section of commercial CWF burners (Coal water fuel), 11:10877 (RA;US)

Correlation of the spray characteristics of coal-water-fuels, 11:10863 (RA;US)
Demonstration and various test applications of COM in Israel (Coal oil mixtures), 11:10834 (RA;US)
Evaluation of anthracite coal water slurries, 11:10861 (RA;US)
Experience with the NRC burner assembly, 11:10881 (RA;US)
Experimental study on coal-water slurry combustion on a 20t/h oil-fired boiler, 11:10889 (RA;US)
Feasibility of wet oxidation for combustion of coal slurries, 11:10878 (RA;US)
Improved combustion of coal water mixtures, 11:10895 (RA;US)
Performance characteristic of coal-water fuels and their impact on boiler operation, 11:10893 (RA;US)
Pilot-scale combustion tests of CWM for a modified water-tube package oil boiler at KIER (Coal water mixtures; Korea Institute of Energy and Resources), 11:10875 (RA;US)
Piston engine for coal-water slurry fuel, 11:10883 (RA;US)
Potential of micronized coal-water slurry as an alternate fuel in oil- and gas-fired boilers, 11:10885 (RA;US)
Production and combustion of hot-water-dried lignite slurries, 11:10827 (RA;US)
Scale-up of coal water fuels experiments in pilot furnaces for evaluation of utility boiler performance, 11:10868 (RA;US)
Size and composition of particulate emissions from the combustion of coal slurries, 11:10807 (RA;US)
Study on the ways of raising combustion efficiency and intensity of coal water slurry, 11:10873 (RA;US)
Sundbyberg coal water fuel fired boiler - experiences gained between the 6th and 7th International Symposium on Coal Slurry Fuels, 11:10888 (RA;US)

Combustion Kinetics
Agglomeration, evaporation and devolatilization of coal water mixture, 11:10871 (RA;US)
Analysis on droplet burning histories of different coal liquid mixtures, 11:10869 (RA;US)
Combustion characteristics of coal and pet-coke water mixtures, 11:10874 (RA;US)
Combustion technology of coal water mixtures, 11:10880 (RA;US)
Comparative combustion studies of ultrafine coal/water slurries and pulverized coal, 11:10870 (RA;US)
Modeling coal-water-mixture spray collective combustion, 11:10876 (RA;US)

Combustion Properties
Coal-sludge mixtures - a sensible coal slurry fuel, 11:10831 (RA;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)

Coordinated Research Programs
Introducing indigenous coal-water-mix fuels to the Philippines: assessment of project feasibility, 11:10892 (RA;US)

Corrosive Effects
Hydraulics data and materials performance from phase I testing of coal water mixtures, 11:10795 (RA;US)

Cost
Capital and operating costs for commercial scale coal-water slurry preparation plants, 11:10914 (RA;US)
Coal slurry production costs, 11:10915 (RA;US)

Demonstration Programs
Demonstration and various test applications of COM in Israel (Coal oil mixtures), 11:10834 (RA;US)

Economics
Coal-sludge mixtures - a sensible coal slurry fuel, 11:10831 (RA;US)
Commercial slurry fuel developments at COMCO, 11:10841 (RA;US)

Fluidized-Bed Combustion
Fluidized bed combustion of coal-water slurry, 11:10879 (RA;US)

Fuel Additives
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, July-September 1985, 11:10855 (R;US)

Fuel Substitution
Cape Breton Development Corporation's CARBOGEL coal water fuel project, 11:10845 (RA;US)
Demonstration and various test applications of COM in Israel (Coal oil mixtures), 11:10834 (RA;US)
Evaluation of anthracite coal water slurries, 11:10861 (RA;US)
Introducing indigenous coal-water-mix fuels to the Philippines: assessment of project feasibility, 11:10892 (RA;US)
Retrofit considerations for adding coal-water-mixture fuel capability at Houston Lighting and Power's Sam Bertron Plant, 11:10894 (RA;US)
Use of coal-water fuels in a contemporary steam locomotive, 11:10884 (RA;US)

Hydraulic Transport
Delivering coal without the dust and noise, 11:10848 (RA;US)
Flow characteristics of coal-water mixtures. Final report, September 1, 1981-September 30, 1984, 11:10912 (R;US)

Maritime Transport
Coal water slurry barge delivery to Boston Edison Mystic 4 for a demonstration test burn, 11:10849 (RA;US)

Materials Handling
Coal water slurry barge delivery to Boston Edison Mystic 4 for a demonstration test burn, 11:10849 (RA;US)
Design considerations for coal-water slurry handling systems at utility and industrial plants, 11:10835 (RA;US)

Mathematical Models
Modeling coal-water-mixture spray collective combustion, 11:10876 (RA;US)

Performance Testing
Flow characteristics of coal-water mixtures. Final report, September 1, 1981-September 30, 1984, 11:10912 (R;US)

PH Value
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, July-September 1985, 11:10855 (R;US)

Physical Properties
Characterization and combustion of low-rank coal-water slurries, 11:10794 (RA;US)
Hydraulics data and materials performance from phase I testing of coal water mixtures, 11:10795 (RA;US)

Production
Advance of SSCT's CWF project in China (State Science and Technology Commission; coal water fuel), 11:10833 (RA;US)
Approach to deashing of some Chinese coals by oil-agglomeration method, 11:10830 (RA;US)
Cape Breton Development Corporation's CARBOGEL coal water fuel project, 11:10845 (RA;US)
Capital and operating costs for commercial scale coal-water slurry preparation plants, 11:10914 (RA;US)
Coal-sludge mixtures - a sensible coal slurry fuel, 11:10831 (RA;US)
Coal water slurry barge delivery to Boston Edison Mystic 4 for a demonstration test burn, 11:10849 (RA;US)
CoaLiquid, Inc. coal slurry fuels commercial program - 1985, 11:10843 (RA;US)
Commercial slurry fuel developments at COMCO, 11:10841 (RA;US)
Demonstration and various test applications of COM in Israel (Coal oil mixtures), 11:10834 (RA;US)
Energy efficiency comparison of coal slurry transportation systems, 11:10847 (RA;US)
Evaluation of anthracite coal water slurries, 11:10861 (RA;US)
Flexible approach to expanding production capacity for Nycol, 11:10842 (RA;US)
Fluid Carbon fuel production and utilization in Sweden, 11:10840 (RA;US)
New way to handle pulverized coal: the pumpable coal/water/air mixtures (C-WAM), 11:10826 (RA;US)
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, July-September 1985, 11:10855 (R;US)
Preparation test of HCWS at a pilot plant in 1984 (Highly-loaded coal water slurry), 11:10838 (RA;US)
Production and combustion of hot-water-dried lignite slurries, 11:10827 (RA;US)

Production of coal-water slurry fuel with low-ash western bituminous coal, 11:10844 (RA;US)
Progress in the design of coal-water fuel plants, 11:10836 (RA;US)
Slurry characteristics of various overseas coal bases on the pilot scale test, 11:10837 (RA;US)
Slurry characteristics of CWS with Highcoal F-3225 in pilot scale production test (Coal water slurry), 11:10839 (RA;US)
Use of intensive mixing in the preparation of CWS, 11:10846 (RA;US)
Rail Transport
Delivering coal without the dust and noise, 11:10848 (RA;US)
Research Programs
Advance of SSCT's CWF project in China (State Science and Technology Commission; coal water fuel), 11:10833 (RA;US)
Slurry characteristics of various overseas coal bases on the pilot scale test, 11:10837 (RA;US)
Rheology
Characterization and combustion of low-rank coal-water slurries, 11:10794 (RA;US)
Handling properties of coal water slurry fuels, 11:10796 (RA;US)
Hydraulics data and materials performance from phase I testing of coal water mixtures, 11:10795 (RA;US)
New way to handle pulverized coal: the pumpable coal/water/air mixtures (C-WAM), 11:10826 (RA;US)
Production and combustion of hot-water-dried lignite slurries, 11:10827 (RA;US)
Slurry characteristics of CWS with Highcoal F-3225 in pilot scale production test (Coal water slurry), 11:10839 (RA;US)
Stability
New way to handle pulverized coal: the pumpable coal/water/air mixtures (C-WAM), 11:10826 (RA;US)
Storage
Design considerations for coal-water slurry handling systems at utility and industrial plants, 11:10835 (RA;US)
Thermal Conductivity
Thermal conductivities of Wilsonville solvent and Wilsonville solvent/Illinois No. 6 coal slurry, 11:10791 (R;US)
Transport
Design considerations for coal-water slurry handling systems at utility and industrial plants, 11:10835 (RA;US)
Energy efficiency comparison of coal slurry transportation systems, 11:10847 (RA;US)
Viscosity
Physical beneficiation process and costs refinement for coal-water slurry manufacture. Quarterly technical progress report, July-September 1985, 11:10855 (R;US)
FUEL SUBSTITUTION
Economic Analysis
Evaluation of anthracite coal water slurries, 11:10861 (RA;US)
FUEL SUSPENSIONS
See FUEL SLURRIES
FUEL-COOLANT INTERACTIONS
Evaluation of the bases for estimating alpha-mode failure probabilities, 11:11350 (R;US)
Molten Metal-Water Reactions
Recent intermediate-scale experiments on fuel-coolant interactions in an open geometry (EXO-FITS), 11:11351 (R;US)
FUELS
See also AUTOMOTIVE FUELS
FOSSIL FUELS
FUEL SLURRIES
JET ENGINE FUELS
REFUSE DERIVED FUELS
SOLID FUELS
SYNTHETIC FUELS
WOOD FUELS
Combustion
Droplet size and evaporation rate within a two-phase flow by morphology-dependent resonances in the optical spectra. Final report, 15 November 1981-31 December 1984, 11:11732 (R;US)
Fuels combustion research, annual report, March 1, 1982-February 28, 1983, 11:11730 (R;US)
Multiple ignition, combustion, and quenching of hydrocarbon fuel sprays. Annual report, July 1983-July 1984, 11:11729 (R;US)
Gas Chromatography
Aspects of high-resolution gas chromatography as applied to the analysis of hydrocarbon fuels and other complex organic mixtures. Volume 2. Survey of sample-insertion techniques. Final report, January-September 1980, 11:11603 (R;US)
Ignition
Multiple ignition, combustion, and quenching of hydrocarbon fuel sprays. Annual report, July 1983-July 1984, 11:11729 (R;US)
Oxidation
Preignition oxidation characteristics of hydrocarbon fuels. Final report, 15 April 1980-14 October 1984, 11:11728 (R;US)
FUELWOOD
See WOOD FUELS
FUJITSU COMPUTERS
Performance
FACOM VP supercomputer of parallel pipeline processing system has achieved 7.5 ns machine cycle, 11:12525 (TG;US)
FUMES
See AEROSOLS
FUNGAL DISEASES
Pathogenesis
Fungal penetration of defensive barriers of plants, 11:11933 (RA;US)
FUNGI
Comparative Evaluations
Biodegradation and bioconversion of coals by fungi. Quarterly progress report No. 1, October 1-December 31, 1985 (Candida sp. and T. versicolor), 11:10787 (R;US)
FURNACE OIL
See HEATING OILS
FURNACES
See also GAS FURNACES
OIL FURNACES
SOLAR FURNACES
WOOD BURNING FURNACES
Heat Exchangers
Condensing heat exchanger systems for residential/commercial furnaces and boilers. Phase IV, 11:11413 (R;US)
Mathematical Models
Detailed model for practical pulverized coal furnaces and gasifiers. Quarterly technical progress report No. 2, August 1-October 31, 1985, 11:10910 (R;US)
FUSED SALTS
See MOLTEN SALTS
FUSION ENERGY
See THERMONUCLEAR REACTORS
FUSION (MELTING)
See MELTING
FUSION REACTIONS
See HEAVY ION FUSION REACTIONS
FUSION REACTORS
See THERMONUCLEAR REACTORS

G

GADOLINIUM
Ion-Atom Collisions
L-shell X-ray production cross sections in Nd, Gd, Ho, Yb, Au and Pb for 25-MeV carbon and 32-MeV oxygen ions, 11:12110 (J;NL)
GADOLINIUM 155
Shell Models
Fragmentation of subshells in rare earth nuclei, 11:12337 (R;SU;In Russian)
Strength Functions
Fragmentation of subshells in rare earth nuclei, 11:12337 (R;SU;In Russian)

GALACTOSE
Biological Effects
Auxin-induced modifications of cell wall polysaccharides in cat coleoptile segments. Effect of galactose, 11:11932 (RA;US)
GALACTURONIC ACID
Biochemistry
Identification of oligogalacturonide-elicitors of phytoalexin accumulation released from sodium polypectate by an endopolygalacturonic acid lyase, 11:11937 (RA;US)
GALAXIES
Astrophysics
Astrophysics. Volume 2. Interstellar matter and galaxies (Text book), 11:12050 (B;US)
GALLIUM ARSENIDE SOLAR CELLS
Coatings
Indium tin oxide/gallium arsenide solar cells, 11:11171 (J;US)
Fabrication
Indium tin oxide/gallium arsenide solar cells, 11:11171 (J;US)
Performance
Indium tin oxide/gallium arsenide solar cells, 11:11171 (J;US)
GALLIUM ARSENIDES
Crystallography
Applications of heavy-ion Rutherford backscattering spectrometry (HIRBS) to the analysis of contact structures on GaAs and Ge, 11:11543 (J;NL)
Magneto-Optical Effects
Pressure-dependent magneto-optic measurements in strained-layer superlattices at low temperatures, 11:11586 (R;US)
Phosphorus Additions
30-MeV electron-beam irradiation effects on GaAs(1-x)P(x) LEDS (light emitting diodes). Master's thesis, 11:11572 (R;US)
Physical Radiation Effects
30-MeV electron-beam irradiation effects on GaAs(1-x)P(x) LEDS (light emitting diodes). Master's thesis, 11:11572 (R;US)
Superlattices
Optical imaging of dislocations in strained-layer superlattices and lattice-mismatched epilayers, 11:11588 (R;US)
GALLIUM PHOSPHIDES
Magneto-Optical Effects
Pressure-dependent magneto-optic measurements in strained-layer superlattices at low temperatures, 11:11586 (R;US)
Superlattices
Optical imaging of dislocations in strained-layer superlattices and lattice-mismatched epilayers, 11:11588 (R;US)
GAMMA DETECTION
Plastic Scintillation Detectors
The Pajarito Monitor: a high-sensitivity monitoring system for highly enriched uranium, 11:11840 (J;US)
Radiation Monitors
Pocket gamma ray monitor including semiconductor detector and numerical display, 11:11829 (RA;AT)
GAMMA DOSIMETRY
Dosemeters
Possible secondary standard for lethal dose measurements in radiological research and accident dosimetry, 11:11827 (RA;AT)
Thermoluminescent Dosemeters
Investigations of a new thermoluminescent bulb dosimeter, 11:11824 (RA;AT)
GAMMA LOGGING
Analog-to-Digital Converters
Processing of gamma-ray spectrometric logs, 11:11849 (R;FR;In French)
GAMMA RADIATION
Dose Rates
Ionization rate measurements, 11:11852 (R;US)
Self-Absorption
Determination of gamma-ray peak efficiency, including correction for self-absorption, in cubic samples, 11:12380 (R;AU)
GAMMA REACTIONS
See PHOTONUCLEAR REACTIONS
GAMMA SPECTROSCOPY
Analog-to-Digital Converters
Processing of gamma-ray spectrometric logs, 11:11849 (R;FR;In French)
GAS ANALYSIS
Accuracy
Effect of in-situ heat treatment on coal char reactivity. Ostwald equations and combustion efficiency in hydrocarbon and coal flames. Progress report, 11:10909 (R;US)
GAS BURSTS
See ROCK BURSTS
GAS CENTRIFUGES
Hydrodynamics
Computer extended asymptotic series for the two-dimensional linear hydrodynamics of a gas centrifuge with sources and sinks, 11:10979 (R;US)
GAS CHROMATOGRAPHY
Aspects of high-resolution gas chromatography as applied to the analysis of hydrocarbon fuels and other complex organic mixtures. Volume 2. Survey of sample-insertion techniques. Final report, January-September 1980, 11:11603 (R;US)
GAS COMPRESSORS
Performance Testing
Performance results from the Hydrogen Technology Evaluation Center at Brookhaven National Laboratory, 11:11119 (R;US)
GAS CONDENSATES
Activated Sludge Process
Biotreatment of UCG condensate and pattern water, 11:10765 (RA;US)
Hot Gas Cleanup
Biotreatment of UCG condensate and pattern water, 11:10765 (RA;US)
Solvent Extraction
Biotreatment of UCG condensate and pattern water, 11:10765 (RA;US)
GAS COOLANTS
See GASES
GAS ENGINES
See INTERNAL COMBUSTION ENGINES
GAS FLOW
Computer Codes
TOPAZ - the transient one-dimensional pipe flow analyzer: equations and numerics, 11:12132 (R;US)
Flow Models
Prediction of flow rates through an orifice at pressures corresponding to the transition between molecular and isentropic flow, 11:11763 (R;US)
GAS FURNACES
Fouling
Potential of micronized coal-water slurry as an alternate fuel in oil- and gas-fired boilers, 11:10885 (RA;US)
Fuel Substitution
Potential of micronized coal-water slurry as an alternate fuel in oil- and gas-fired boilers, 11:10885 (RA;US)
Performance Testing
Potential of micronized coal-water slurry as an alternate fuel in oil- and gas-fired boilers, 11:10885 (RA;US)
GAS GENERATORS
Economics
Displacement of industrial oil consumption in developing countries by wood fuel technologies, 11:11148 (RA;PR)
Power Generation
Using agricultural waste in gas generators and its importance for developing countries, 11:11211 (RA;DE;In German)
Technology Assessment
Displacement of industrial oil consumption in developing countries by wood fuel technologies, 11:11148 (RA;PR)
GAS HEAT PUMPS
Design
Balance-sheet of a large-scale heat pump system for heating a residential complex, 11:11432 (RA;DE;In German)
Most efficient way of transforming natural gas into heat, cooling and electricity, 11:11471 (RA;DE;In German)
Structure of the plant and results of measurement of energy requirement for the supply of heat and cold to the administration building at Thyssengas in Duisburg, 11:11436 (RA;DE;In German)

Economic Analysis
Development of a residential gas fired absorption heat pump. Physical and thermodynamic properties of R123A/ETFE system development and testing economic analysis. Final report, 11:11447 (R;US)
Economics
Balance-sheet of a large-scale heat pump system for heating a residential complex, 11:11432 (RA;DE;In German)
Energy Consumption
Structure of the plant and results of measurement of energy requirement for the supply of heat and cold to the administration building at Thyssengas in Duisburg, 11:11436 (RA;DE;In German)
Performance Testing
Development of a residential gas fired absorption heat pump. Physical and thermodynamic properties of R123A/ETFE system development and testing economic analysis. Final report, 11:11447 (R;US)

GAS HYDRATES
Gas Chromatography
Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)
Stability
Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)

GAS TURBINE ENGINES
Technology Assessment
Small-turbine technology review. Final report, February-December 1984, 11:11457 (R;US)

GAS TURBINES
Nozzles
Combustion of coal water slurry in a gas turbine combustor, 11:10882 (RA;US)
Performance
Combustion of coal water slurry in a gas turbine combustor, 11:10882 (RA;US)

GASEOUS EFFLUENTS
See GASEOUS WASTES

GASEOUS WASTES
See also FLUE GAS
Diffusion
Climatological data for site selection and planning, 11:11880 (BA;US)
Quantitative Chemical Analysis
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)

GASES
See also AIR
ELECTRON GAS
FUEL GAS
SYNTHESIS GAS
Chemical Reactions
Analytical solution for a first-order reaction in a packed bed with diffusion, 11:11665 (J;US)
Time-resolved Auger electron spectroscopy combined with modulated molecular beam techniques for gas-surface reaction kinetics studies, 11:11662 (J;NL)
Reaction Kinetics
Measurement of rate constants of elementary gas reactions of importance to upper atmosphere and combustion systems. Final technical report, 1 September 1980-28 February 1985, 11:11731 (R;US)
Thermal Shock
Shock-induced thermal runaway, 11:11733 (R;US)

GASIFICATION
See also COAL GASIFICATION
IN-SITU GASIFICATION
Commercialization
Identifying barriers to the commercialization of low-Btu gasifiers, 11:11144 (R;US)

GASOLINE ENGINES
See INTERNAL COMBUSTION ENGINES

GDL FACILITY
[Glass Development Laser (GDL) Facility upgrade.] LLE Review. Quarterly report, October-December 1984. Volume 21, 11:12487 (R;US)

GE STANDARD REACTOR
Prior to 1975, BWR/6 Type Reactors was used.
Containment
Containment performance evaluation for the GESSAR-II plant for seismic initiating events, 11:11293 (R;US)
Mechanistic determination of fission product releases for a Mark III BWR plant, 11:11297 (R;US)
Loss of Coolant
Analysis of hydrogen production during a BWR6 core heatup transient, 11:11296 (R;US)
Meltdown
Mechanistic determination of fission product releases for a Mark III BWR plant, 11:11297 (R;US)
Reactor Core Disruption
Analysis of hydrogen production during a BWR6 core heatup transient, 11:11296 (R;US)
Risk Assessment
Containment performance evaluation for the GESSAR-II plant for seismic initiating events, 11:11293 (R;US)
Seismic Effects
Containment performance evaluation for the GESSAR-II plant for seismic initiating events, 11:11293 (R;US)

GEIGER-MUELLER COUNTERS
Performance
Application of Si detectors, photo-diodes and G-M counters in exposure rate measurements, 11:11823 (RA;AT)

GENE LOCI
See GENES

GENE OPERONS
Chemical Preparation
[Templates, site specifically modified with carcinogens]. Final report, 11:11947 (R;US)
DNA-Cloning
[Templates, site specifically modified with carcinogens]. Final report, 11:11947 (R;US)

GENERAL ELECTRIC STANDARD REACTOR
See GE STANDARD REACTOR

GENERATOR-COORDINATE METHOD
Kernels
From GCM energy kernels to Weyl-Wigner Hamiltonians: a particular mapping, 11:12403 (R;BR)

GENERATORS (RADIOISOTOPE)
See RADIOISOTOPE GENERATORS

GENERATORS (STEAM)
See STEAM GENERATORS

GENES
DNA-Cloning
Gene cloning as an approach to understanding specificity in plant-pathogen systems, 11:11964 (RA;US)

GENETIC RADIATION EFFECTS
Biological Dosemeters
Comparative studies of the dose-response relationship of radiation-induced chromosomal aberrations in human lymphocytes induced by low radiation doses, using Feulgen orcein glacial acetic acid and FPG staining, 11:11996 (R;DE;In German)
Mathematical Models
Health effects model for nuclear power plant accident consequence analysis. Part I. Introduction, integration, and summary. Part II. Scientific basis for health effects models, 11:11997 (R;US)

GEOLOGIC DEPOSITS
See also COAL DEPOSITS
NATURAL GAS DEPOSITS
NATURAL GAS HYDRATE DEPOSITS
PETROLEUM DEPOSITS
SALT DEPOSITS
URANIUM DEPOSITS
Radioactive Waste Disposal
PAGIS summary report of phase 1: a common methodological approach based on European data and models, 11:11016 (R;IT)
Spent fuel performance in geologic repository environments, 11:11029 (R;US)

GEOMAGNETIC FIELD
Plasma Drift
Behavior of ionized plasma in the high latitude topside ionosphere. Memorandum report, 11:12054 (R;US)
GEORGES BANK
Water Pollution
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 27, 11:10942 (R;US)
GEORGIA
Industrial Plants
Industrial wood energy feasibility studies, 11:11149 (RA;PR)
GEOTHERMAL ENERGY
Meetings
Geothermal Program Review IV: proceedings, 11:11199 (R;US)
Research Programs
Geothermal Program Review IV: proceedings, 11:11199 (R;US)
Hawaii Natural Energy Institute annual report, July 1982-June 1983, 11:11405 (R;US)
Hawaii Natural Energy Institute annual report, July 1981-June 1982, 11:11383 (R;US)
Hawaii Natural Energy Institute annual report, 1984, 11:11384 (R;US)
GEOTHERMAL FLUIDS
Chemical Composition
Study in applied geochemistry. Geothermal water, 11:11203 (R;FR;In French)
GEOTHERMAL RESOURCES
Energy Source Development
Impact of geothermal development on the state of Hawaii. Executive summary. Volume 7, 11:11200 (R;US)
GEOTHERMAL WELLS
Fluid Injection
Identification of the response parameters of a geothermal field during a non-isothermal short time water injection test, 11:11202 (R;FR;In French)
GERMAN FEDERAL REPUBLIC
See FEDERAL REPUBLIC OF GERMANY
GERMANIUM
Crystallography
Applications of heavy-ion Rutherford backscattering spectrometry (HIRBS) to the analysis of contact structures on GaAs and Ge, 11:11543 (J;NL)
Laser-Radiation Heating
Time-resolved reflectivity measurements of silicon and germanium pulsed excimer laser irradiation, 11:11576 (R;US)
Melting
Time-resolved reflectivity measurements of silicon and germanium pulsed excimer laser irradiation, 11:11576 (R;US)
Neon 20 Reactions
Observation of a long-lived nuclear quasimolecule in the ^{20}Ne + Ge system, 11:12324 (R;SU;In Russian)
Photoconductive Cells
Transient and temperature-dependent phenomena in Ge:Be and Ge:Zn far infrared photoconductors, 11:11583 (R;US)
Solid-State Plasma
Chaos and turbulence in an electron-hole plasma in germanium, 11:11523 (R;US)
GERMANIUM 76
Double Beta Decay
The LBL/UCSB ^{76}Ge double beta decay experiment: first results, 11:12325 (J;US)
GERMANIUM 76 TARGET
Heavy Ion Fusion Reactions
Fission-like phenomena for systems with mass A=110, 11:12312 (R;FR)
GERMANIUM ISOTOPES
See also GERMANIUM 76
Electron Reactions
Quadrupole boson densities in the germanium region by inelastic electron scattering, 11:12328 (R;FR)
GERMANY (FEDERAL REPUBLIC)
See FEDERAL REPUBLIC OF GERMANY
GERMS (MICROORGANISMS)
See MICROORGANISMS
GLASS
See also BOROSILICATE GLASS
Chemical Composition
Results from the long-term interaction and modeling of SRL-131 glass with aqueous solutions (Leachants; deionized water; salt brine; simulated ground water; silicate water), 11:11060 (R;US)
Chemical Reaction Kinetics
Silicon nitride joining, 11:11560 (J;US)
Fracture Properties
Multiaxial stress response of ceramics. Progress report, December 1, 1984-November 30, 1985, 11:11553 (R;US)
Joining
Silicon nitride joining, 11:11560 (J;US)
Leaching
Effects of α-radiolysis on leaching of a nuclear waste glass, 11:11046 (J;US)
Results from the long-term interaction and modeling of SRL-131 glass with aqueous solutions (Leachants; deionized water; salt brine; simulated ground water; silicate water), 11:11060 (R;US)
Radiolysis
Effects of α-radiolysis on leaching of a nuclear waste glass, 11:11046 (J;US)
GLASS DEVELOPMENT LASER FACILITY
See GDL FACILITY
GLASS MELTERS
See CERAMIC MELTERS
GLOBAL RISK
See HAZARDS
GLUCOPROTEINS
Biochemistry
Glycoprotein component of plant cell walls, 11:11953 (RA;US)
Biosynthesis
Intracellular localization of hydroxyproline-rich glycoprotein biosynthesis, 11:11930 (RA;US)
Regulation of glycoprotein synthesis in yeast by mating pheromones, 11:11926 (RA;US)
GLUCOSE
Uptake
Utilization of glucose and UDPG by supprotoplasts of cotton fiber cells, 11:11940 (RA;US)
GLUCURONIDE CONJUGATES
Mutagenesis
Detoxication mechanisms of benzo(a)pyrene as studied in the CHO/HGPRT assay, 11:12006 (R;US)
GLUTATHIONE CONJUGATES
Mutagenesis
Detoxication mechanisms of benzo(a)pyrene as studied in the CHO/HGPRT assay, 11:12006 (R;US)
GLYCOPROTEINS
See GLUCOPROTEINS
GLYCOSYL HYDROLASES
Code number 3.2.
Biochemistry
Depolymerization of matrix polysaccharides by endogenous wall enzymes, 11:11929 (RA;US)
GOBAR GAS
See METHANE
GOLD
Auger Effect
Technique for comparing AES signals from different spectrometers using common materials, 11:11621 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
Ion-Atom Collisions
L-shell X-ray production cross sections in Nd, Gd, Ho, Yb, Au and Pb for 25-MeV carbon and 32-MeV oxygen ions, 11:12110 (J;NL)
M-shell electron capture and direct ionization of gold by 25-MeV carbon and 32-MeV oxygen ions, 11:12111 (J;NL)
Physical Radiation Effects
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)

Raman scattering in experiments with planar Au targets irradiated with 0.53 μm laser light, 11:11532 (J;US)
Sorptive Properties
Surface-suppressed electron resonance spectroscopies, 11:11650 (J;US)
GOLD 197 TARGET
Alpha Reactions
Emission of light fragments ^{3}H, ^{3}He and ^{4}He in ^{4}He-nucleus collisions at 3.33 GeV/N kinetic energy, 11:12369 (R;SU)
Argon 40 Reactions
Sequential fission angular distributions from mass-asymmetric heavy-ion reactions, 11:12346 (J;NL)
Neutron Reactions
Neutron-capture cross-section measurements for ^{115}In and ^{197}Au in the energy region 2.0-7.7 MeV, using the activation technique, 11:12331 (R;SE)
GOLD ALLOYS
Physical Radiation Effects
Current research using the ANL High Voltage Electron Microscope Tandem Accelerator facility (Electron and ion irradiation), 11:11544 (J;NL)
GOLD IONS
Ion-Atom Collisions
Correlated two electron effects in collisions of multiply-charged Au ions with He, 11:12107 (J;NL)
GOLGI APPARATUS
See ORGANOIDS
GRADED BAND GAP SOLAR CELLS
See CASCADE SOLAR CELLS
GRADED LIE GROUPS
Irreducible Representations
Irreducible *-representations of Lie superalgebras B(O,n) with finite-degenerated vacuum. Results for B(O,1), 11:12248 (R;SU)
GRAFTS
Radioimmunology
Effects of irradiation on frozen corticocancellous bone allograft incorporation and immunogenicity. Final report, 11:11988 (R;US)
GRAIN ALCOHOL
See ETHANOL
GRAIN GROWTH
Crystal Models
Grain growth in three dimensions: a lattice model, 11:11546 (J;US)
Time Dependence
Grain growth in three dimensions: a lattice model, 11:11546 (J;US)
GRAMINEAE
See GRASS
GRAND UNIFIED THEORY
Algebra
Grassmann-Schoenberg algebras and grand unification, 11:12240 (R;BR;In Portuguese)
Rest Mass
Low-energy predictions of a two-loop finite supersymmetric SU_5 theory, 11:12265 (J;NL)
GRANITES
Radioactive Waste Disposal
Final report of the migration in a single fracture - experimental results and evaluation, 11:11903 (R;SE)
Radionuclide Migration
Final report of the migration in a single fracture - experimental results and evaluation, 11:11903 (R;SE)
GRANULAR BED FILTERS
Performance Testing
Anaerobic treatment of gasifier effluents. Final report, 11:10803 (R;US)
GRANULAR MATERIALS
For unspecified materials having a granular texture.
Flow Models
Lawrence Livermore National Laboratory Granular Flow Project. Quarterly report, October-December 1985, 11:11764 (R;US)
Solids Flow
Lawrence Livermore National Laboratory Granular Flow Project. Quarterly report, October-December 1985, 11:11764 (R;US)
GRAPHITE
Mass Spectroscopy
Comment on "High-resolution scanning-ion-microprobe study of graphite and its intercalation compounds", 11:11592 (J;US)
Morphology
Comment on "High-resolution scanning-ion-microprobe study of graphite and its intercalation compounds", 11:11592 (J;US)
GRAPHITE MODERATOR
See GRAPHITE
GRASS
See also SUGAR CANE
Contamination
Lead as an environmental pollutant, 11:11895 (RA;XE)
Electrolysis
Products found in the anodic oxidation of coal, 11:11122 (J;GB)
GRAVITATION
Lagrangian Function
Analogue of the Witten effect in the Poincare gauge theory of gravity, 11:12231 (R;IT)
GRAVITATIONAL COLLAPSE
Mathematical Models
2-D Eulerian hydrodynamics with fluid interfaces, self-gravity and rotation, 11:12042 (R;US)
GRAVITATIONAL WAVES
Reviews
Heuristic introduction to gravitational waves, 11:12419 (J;US)
GREAT BRITAIN
See UNITED KINGDOM
GREAT LAKES
Fallout Deposits
Great Lakes regional fallout source functions. Technical memo., 11:11920 (R;US)
Radionuclide Migration
Coupled lakes model for estimating the long-term response of the Great Lakes to time-dependent loadings of particle-associated contaminants. Technical Memo., 11:11919 (R;US)
Water Pollution
Coupled lakes model for estimating the long-term response of the Great Lakes to time-dependent loadings of particle-associated contaminants. Technical Memo., 11:11919 (R;US)
GREAT LAKES BASIN
Fallout Deposits
Great Lakes regional fallout source functions. Technical memo., 11:11920 (R;US)
Radionuclide Migration
Coupled lakes model for estimating the long-term response of the Great Lakes to time-dependent loadings of particle-associated contaminants. Technical Memo., 11:11919 (R;US)
GREECE
Energy Policy
Greece - energy situation 1983/1984, 11:11394 (R;DE;In German)
Energy Supplies
Greece - energy situation 1983/1984, 11:11394 (R;DE;In German)
GREEN FUNCTION
Yang-Mills Theory
Property of Euclidean Green functions of SU(2) Yang-Mills fields in BPST-instanton background, 11:12247 (R;SU)
GREEN RIVER FORMATION
Extraction of Green River and Chattanooga oil shales with strong bases and nucleophilic displacement reagents, 11:10967 (R;US)
GREENHOUSES
See also ATTACHED GREENHOUSES
Energy Conservation
Thermal insulation and carbon dioxide enhancement in greenhouses, 11:11421 (RA;DE;In German)
Plant Growth
Thermal insulation and carbon dioxide enhancement in greenhouses, 11:11421 (RA;DE;In German)
GROSS-NEVEU MODEL
See LAGRANGIAN FIELD THEORY

GROUND CONTROL
See STRATA CONTROL
GROUND SUBSIDENCE
Mathematical Models
Subsidence modeling of Rawlins underground coal gasification Tests 1 and 2, 11:10772 (RA;US)
Research Programs
Subsidence modeling of Rawlins underground coal gasification Tests 1 and 2, 11:10772 (RA;US)
GROUND WATER
Chemical Composition
Effect of alpha and gamma radiation on the near-field chemistry and geochemistry of high-level waste packages, 11:11031 (R;US)
Contamination
Investigation of the effect of waste disposal procedure modifications on disposal of D-2 waste to the ground, 11:11902 (R;US)
Control
Design of bulkheads for controlling water in underground mines. Information Circular/1985, 11:10824 (R;US)
Flow Models
Development and applications of two finite element groundwater flow and contaminant transport models: FEWA and FEMA, 11:11058 (R;US)
Fluid Flow
HEADCO: a program for converting observed water levels and pressure measurements to formation pressure and standard hydraulic head, 11:12030 (R;US)
Information Systems
Guidebook for the assembly and use of diverse ground water data, 11:12028 (R;US)
Quantitative Chemical Analysis
Geohydrology of rocks penetrated by test well USW H-4, Yucca Mountain, Nye County, Nevada, 11:11040 (R;US)
Radiolysis
Effect of alpha and gamma radiation on the near-field chemistry and geochemistry of high-level waste packages, 11:11031 (R;US)
Radionuclide Migration
Experimentation and modelling of U, Th, and lanthanides transport in fissured rocks. Influence of complexation, 11:11057 (R;FR)
Release mechanisms and their role in the spent fuel repository perfomance, 11:11037 (RA;US)
Water Pollution Control
Sorption and desorption of volatile chlorinated aliphatic compounds by soils and soil components. Doctoral theses, 11:11914 (R;US)
GROUND-WATER RESERVES
See AQUIFERS
GROUTING
Chemical Composition
Annual technology assessment and progress report for the Buried Transuranic Waste Program at the Idaho National Engineering Laboratory, 11:11012 (R;US)
GROWTH (CRYSTAL)
See CRYSTAL GROWTH
GROWTH (GRAIN)
See GRAIN GROWTH
GUARDS
See SECURITY PERSONNEL
GULF COAST
Petroleum Refineries
Alcohols and ideas for savings of petroleum crude at local refineries in the Caribbeans, 11:11136 (RA;PR)
GULF OF ALASKA
Baseline Ecology
Environmental assessment of the Alaskan Continental Shelf. Final reports of principal investigators. Volume 18. Biological studies, 11:10953 (R;US)
Water Pollution
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 27, 11:10942 (R;US)
GULF OF MEXICO
Natural Gas Hydrate Deposits
Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)
GYROTRONS
See MICROWAVE AMPLIFIERS

H

H CODES
Manuals
HEADCO: a program for converting observed water levels and pressure measurements to formation pressure and standard hydraulic head, 11:12030 (R;US)
HADRON REACTIONS
Nuclear Models
Experimental nuclear and radiochemistry. Progress report and review, 1984, 11:12277 (R;US)
HADRON-HADRON INTERACTIONS
See also BARYON-BARYON INTERACTIONS
Particle Production
Signatures for horizontal gauge bosons in very energetic hadronic collisions, 11:12213 (J;US)
HADRONIC ATOMS
See also MESIC ATOMS
Energy Levels
Influence of quark configurations on the spectrum of the hadronic atom, 11:12085 (R;SU)
Quark-Hadron Interactions
Influence of quark configurations on the spectrum of the hadronic atom, 11:12085 (R;SU)
HADRONIC PARTICLE DECAY
Particle decay due to hadronic interaction.
Pair Production
Exclusive decays of heavy mesons into baryons, 11:12215 (J;NL)
HADRONS
See also BARYONS
MESONS
Bag Model
Aspects of hadronic structure, 11:12235 (R;BR;In Portuguese)
Multiple Production
Fragmentation functions for quarks and diquarks in the model of quark-gluon strings, 11:12200 (R;SU)
PLUTO collaboration: e^+e^- interactions at PETRA, 11:12147 (RA;US)
Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)
Particle Production
Study of hadronization using energy flow from e^+e^- annihilation into quarks and gluons at $\sqrt{s}$ of 29 GeV, 11:12163 (R;US)
Particle Structure
Aspects of hadronic structure, 11:12235 (R;BR;In Portuguese)
Quantum Chromodynamics
Aspects of hadronic structure, 11:12235 (R;BR;In Portuguese)
HAEM DEHYDROGENASES
Code number 1.9
Fractionation
One carbon metabolism in anaerobic bacteria: organic acid and methane production. Final technical report, 11:11129 (R;US)
HALL GENERATORS
See MHD GENERATORS
HAM
See MEAT
HANFORD ATOMIC PRODUCTS OPERATION
See HAPO
HANFORD RESERVATION
Stratigraphy
Geology underlying 200-area tank farms, 11:12029 (R;US)

HAPO
Radioactive Waste Disposal
Defense waste and byproducts management monthly report, November 1985, 11:11032 (R;US)
Radioactive Waste Management
Defense waste and byproducts management monthly report, October 1985, 11:11033 (R;US)
Defense waste and byproducts management monthly report, November 1985, 11:11032 (R;US)
Radioactive Waste Processing
Defense waste and byproducts management monthly report, October 1985, 11:11033 (R;US)
Defense waste and byproducts management monthly report, November 1985, 11:11032 (R;US)
Radioactive Waste Storage
Defense waste and byproducts management monthly report, October 1985, 11:11033 (R;US)
Defense waste and byproducts management monthly report, November 1985, 11:11032 (R;US)
HARMONIC OSCILLATORS
Blackbody Radiation
Forced harmonic oscillator with damping and thermal effects, 11:12405 (R;BR)
Equations of Motion
Classical response theory propagators: An illustrative example, 11:12422 (J;US)
Phase Space
Forced harmonic oscillator with damping and thermal effects, 11:12405 (R;BR)
HARRIS-1 REACTOR
Reactor Safety
Conformance to Generic Letter 83-28 Items 3.1.3 and 3.2.3, Shearon Harris Unit 1 (Docket No. 50-400), 11:11309 (R;US)
HARTREE APPROXIMATION
See HARTREE-FOCK METHOD
HARTREE-FOCK METHOD
Many-Body Problem
Theoretical studies of atomic transitions. Progress report, March 15, 1985-March 14, 1986, 11:12077 (R;US)
Time Dependence
Time dependent Hartree-Fock theory of ion-atom collisions: Application to F^{9+} /Ne, 11:12103 (J;NL)
HARTREE-FOCK-BOGOLYUBOV THEORY
Wave Functions
Analysis of angular-momentum-projected Hartree-Fock-Bogoliubov wave functions in terms of interacting bosons, 11:12376 (J;NL)
HAUSDORFF SPACE
Dimensions
Hausdorff dimensions for sets with broken scaling symmetry, 11:12420 (R;US)
HAWAII
Geothermal Resources
Impact of geothermal development on the state of Hawaii. Executive summary. Volume 7, 11:11200 (R;US)
HAZARDS
Meetings
DOE natural phenomena hazards mitigation conference: proceedings, 11:11769 (R;US)
HCDA
See REACTOR CORE DISRUPTION
H-COAL PROCESS
Chemical Effluents
Comparative biology and chemistry of boiling point fractions from different coal liquefaction processes, 11:10927 (R;US)
HCP LATTICES
Free Energy
Free energy difference calculations comparing fcc and hcp structures using molecular dynamics computer simulations, 11:12398 (J;US)
Stability
Free energy difference calculations comparing fcc and hcp structures using molecular dynamics computer simulations, 11:12398 (J;US)
HDO
See HEAVY WATER
HEALTH PHYSICS
See RADIATION PROTECTION
HEART
See also MYOCARDIUM
Computerized Tomography
Determination of the left ventricular volumina by computerized tomography, as compared to laevo-angiocardiography, 11:11977 (R;DE;In German)
HEAT DISSIPATION
See DIFFUSION
ENVIRONMENTAL TRANSPORT
HEAT TRANSFER
HEAT EXCHANGERS
Cavity Receivers
Solar thermochemical hydrogen: the heat source-process interface, 11:11123 (J;GB)
Corrosion Resistance
Condensing heat exchanger systems for residential/commercial furnaces and boilers. Phase IV, 11:11413 (R;US)
Design
Solar thermochemical hydrogen: the heat source-process interface, 11:11123 (J;GB)
Fouling
On-line measurements of fouling and slagging (full-scale and pilot units) and correlation with predictive indices in conventionally fired steam generators, 11:11212 (RA;US)
Heat Flux
Heat flux limiting sleeves, 11:11259 (P;US)
Sleeves
Heat flux limiting sleeves, 11:11259 (P;US)
Standards
Heat exchanger requirements for potable water protection. Final report, 11:11446 (R;US)
HEAT PIPES
Feasibility Studies
Ceramic heat pipe waste heat recovery. Phase I report, August 1, 1984-April 30, 1985, 11:11477 (R;US)
HEAT PUMPS
See also AIR SOURCE HEAT PUMPS
GAS HEAT PUMPS
WATER SOURCE HEAT PUMPS
Energy Conservation
Vapor-compression heat pump system field tests at the TECH complex, 11:11456 (J;US)
Vapor Compression Refrigeration Cycle
Vapor-compression heat pump system field tests at the TECH complex, 11:11456 (J;US)
HEAT RECOVERY EQUIPMENT
Heat Pipes
Ceramic heat pipe waste heat recovery. Phase I report, August 1, 1984-April 30, 1985, 11:11477 (R;US)
HEAT RESISTING ALLOYS
See also STAINLESS STEEL-304
STAINLESS STEEL-316
STAINLESS STEEL-347
Creep
Creep-rupture behavior of iron superalloys in high-pressure hydrogen, 11:11516 (R;US)
Mechanical Properties
Creep rupture behavior of Stirling engine materials (Iron-base NASAUT 4G-Al), 11:11517 (R;US)
HEAT STORAGE DEVICES
See THERMAL ENERGY STORAGE EQUIPMENT
HEAT STORAGE SYSTEMS
See THERMAL ENERGY STORAGE EQUIPMENT
HEAT TRANSFER
Mathematical Models
Modelling of heat transfer and furnace conditions in pulverised coal fired boilers, 11:11214 (RA;US)
One-Dimensional Calculations
Formulation of hyperbolic Stefan problems, 11:11765 (J;US)
Transients
Analysis of the effects of transient heat transfer on axial-flow-compressor-blade boundary layers. Master's thesis, 11:11762 (R;US)
HEAT TRANSMISSION
See HEAT TRANSFER
HEATER OIL
See HEATING OILS

HEATING OILS
Carcinogen Screening
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Chemical Properties
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Mutagen Screening
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Physical Properties
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)

HEATING SYSTEMS
See also SOLAR HEATING SYSTEMS
Research Programs
Thermal distribution and utilization: an interim progress report, 11:11412 (R;US)

HEAVY FUELS
See RESIDUAL FUELS

HEAVY ION FUSION REACTIONS
Coupled Channel Theory
Theory of the heavy ion fusion cross section, 11:12363 (R;BR)
Nuclear Potential
Optical potential ambiguities and fusion cross sections for heavy ions, 11:12377 (J;NL)
Optical Models
Optical potential ambiguities and fusion cross sections for heavy ions, 11:12377 (J;NL)
Research Programs
Fiscal year 1986, Department of Energy authorization (magnetic fusion energy and departmental administration and supporting services activities). Volume V. Hearings before the Subcommittee on Energy Research and Production of the Committee on Science and Technology, House of Representatives, Ninety-Ninth Congress, First Session, March 8, 18, 1985, 11:12424 (B;US)
Research in nuclear physics. Progress report, April 1, 1985-March 31, 1986, 11:12297 (R;US)

HEAVY ION REACTIONS
See also ARGON 40 REACTIONS
BERYLLIUM 9 REACTIONS
CARBON 12 REACTIONS
KRYPTON 84 REACTIONS
LITHIUM 6 REACTIONS
LITHIUM 7 REACTIONS
LITHIUM 8 REACTIONS
NEON 20 REACTIONS
NICKEL 58 REACTIONS
NITROGEN 14 REACTIONS
OXYGEN 16 REACTIONS
OXYGEN 18 REACTIONS
SILICON 28 REACTIONS
SULFUR 32 REACTIONS
Nuclear Deformation
Deformation effects in the heavy ion quarter-point angle, 11:12367 (R;BR)
Particle Production
Subthreshold kaon production as a probe of the nuclear equation of state, 11:12375 (J;US)
Potentials
Polarization potentials in heavy ion scattering, 11:12364 (R;BR)
Research Programs
Research in nuclear physics. Progress report, April 1, 1985-March 31, 1986, 11:12297 (R;US)
Spin Orientation
Polarization potentials in heavy ion scattering, 11:12364 (R;BR)
Statistical Models
Statistics at work in heavy-ion reactions, 11:12378 (BA;NL)

HEAVY IONS
Whenever possible use one of the more specific terms listed under ION BEAMS.
Particle Identification
Heavy-ion identification using detector telescopes, 11:11839 (BA;US)

HEAVY OILS
See PETROLEUM
VISCOSITY

HEAVY WATER
Production
Technical and economical feasibility studies and preliminary plan of a heavy water plant by the cryogenic distillation method of hydrogen, 11:11111 (R;CL;In Spanish)

HEAVY WATER COOLANT
See HEAVY WATER

HEAVY WATER MODERATOR
See HEAVY WATER

HEAVY WATER PLANTS
Economic Analysis
Technical and economical feasibility studies and preliminary plan of a heavy water plant by the cryogenic distillation method of hydrogen, 11:11111 (R;CL;In Spanish)
Feasibility Studies
Technical and economical feasibility studies and preliminary plan of a heavy water plant by the cryogenic distillation method of hydrogen, 11:11111 (R;CL;In Spanish)

HELIUM
Ion-Atom Collisions
Correlated two electron effects in collisions of multiply-charged Au ions with He, 11:12107 (J;NL)

HELIUM 3
See also HELIUM 3 B
Ion Sources
Polarized ^{3}He ion source for the Van de Graaff based on the 2^3S_1 state of helium. Progress report, 11:11803 (R;CA;In French)
Momentum Transfer
Momentum distribution of ^{3}He, 11:11593 (J;US)

HELIUM 3 B
Hydrodynamics
Spin-hydrodynamic equations with external disturbances and suitable Green's functions for superfluid ^{3}He-B. New Onsager relations, 11:12137 (J;US)
Onsager Relations
Spin-hydrodynamic equations with external disturbances and suitable Green's functions for superfluid ^{3}He-B. New Onsager relations, 11:12137 (J;US)

HELIUM 3 TARGET
Deuteron Reactions
Measurement and application of DDsub(γ), DTsub(γ) and D^{3}Hesub(γ) reactions at low energy, 11:12291 (J;NL)
Electron Reactions
Structure of the $^3H \rightarrow n + d(d^*)$ vertexes, 11:12292 (BA;NL)
Photonuclear Reactions
Study of the ^{3}He(γp)np reaction in the region of the resonance Δ(1232), 11:12285 (R;FR;In French)
Pion Minus Reactions
Quasi-free scattering of π^+ and π from ^{3}He and ^{4}He at energies from 350 to 475 MeV, 11:12293 (BA;NL)
Pion Plus Reactions
Quasi-free scattering of π^+ and π from ^{3}He and ^{4}He at energies from 350 to 475 MeV, 11:12293 (BA;NL)
Proton Reactions
Structure of the $^3H \rightarrow n + d(d^*)$ vertexes, 11:12292 (BA;NL)

HELIUM 4 REACTIONS
See ALPHA REACTIONS

HELIUM 4 TARGET
Alpha Reactions
Search for quark deconfinement: Strangeness production in pp, dd, pα, and αα collisions at √s/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)
Pion Minus Reactions
Quasi-free scattering of π^+ and π from ^{3}He and ^{4}He at energies from 350 to 475 MeV, 11:12293 (BA;NL)
Pion Plus Reactions
Quasi-free scattering of π^+ and π from ^{3}He and ^{4}He at energies from 350 to 475 MeV, 11:12293 (BA;NL)
Proton Reactions
Search for quark deconfinement: Strangeness production in pp, dd, pα, and αα collisions at √s/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)

HELIUM DILUTION REFRIGERATORS
Installation
K500 cyclotron magnet, 11:11795 (RA;US)

HELIUM II
The phase of liquid helium-4 which is stable at temperatures between absolute zero and the lambda point (about 2.2 K).
Energy-Level Transitions
Transition probabilities in superfluid He4, 11:12129 (R;IT)
HELIUM IONS
Ion-Atom Collisions
Coincidence techniques to study electron emission in ion-atom collisions, 11:12108 (J;NL)
HEMICELLULOSE
Enzymatic Hydrolysis
Possible role for hemicelluloses in fruit softening, 11:11941 (RA;US)
Liquid Column Chromatography
Possible role for hemicelluloses in fruit softening, 11:11941 (RA;US)
HERA STORAGE RING
Hadron Elektron Ring Anlage
Beam Optics
Electron ring design for HERA, including spin-matching, 11:11808 (RA;US)
HETEROCYCLIC COMPOUNDS
See also AZINES
AZOLES
PHTHALOCYANINES
THIOPHENE
TMTSF
Chemical Preparation
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Chemical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of M(Ph$_2$PCH$_2$PPh$_2$)$_2$Cl$_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Chemical Reactions
New method of synthesizing stilbene compounds with heterocyclic substituents, anil synthesis, 11:11698 (TJ;US)
Crystal Structure
Circular and flip-flop hydrogen bonding in β-cyclodextrin undecahydrate: neutron diffraction study, 11:11697 (J;US)
Structure of 3,4;3',4'-bis(ethylenedithio)-2,2',5,5'-tetrathiafulvalent-tetrabromoindate (2:1), (BEDT-TTF)$_2$InBr$_4$, ($C_{10}H_8S_8$)$_2$InBr$_4$, 11:11601 (J;DK)
Excited States
Charge-transfer luminescence from mixed-ligand, 2,2',2"-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)
Isomerization
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of M(Ph$_2$PCH$_2$PPh$_2$)$_2$Cl$_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Luminescence
Charge-transfer luminescence from mixed-ligand, 2,2',2"-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)
Molecular Structure
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Neutron Diffraction
Circular and flip-flop hydrogen bonding in β-cyclodextrin undecahydrate: neutron diffraction study, 11:11697 (J;US)
Photolysis
Laser photolysis of 2-phenylheptamethyltrisilane, 11:11709 (J;NL)
Steady-state and laser flash photolysis studies of bridgehead-substituted dibenzobarrelenes, 11:11706 (J;US)
Physical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of M(Ph$_2$PCH$_2$PPh$_2$)$_2$Cl$_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
HETERODYNE RECEIVERS
Superconducting Junctions
Characterization of SIS functions in a heterodyne receiver at 33GHz, 11:11822 (R;FR;In French)
HEXAGONAL CLOSE PACKED
See HCP LATTICES
HEXANE
Electron Mobility
Effect of high pressure on the electron mobility in liquid n-hexane, 2,2-dimethylbutane, and tetramethylsilane, 11:11686 (J;US)
HEXANOLS
Solubility
Removal of n-alcohols from an aqueous stream using micellar-enhanced ultrafiltration, 11:11672 (R;US)
Ultrafiltration
Removal of n-alcohols from an aqueous stream using micellar-enhanced ultrafiltration, 11:11672 (R;US)
HEXYL ALCOHOLS
See HEXANOLS
HFIR REACTOR
Design
Thermal reactor design for a neutron scattering source facility, 11:11287 (R;US)
Manuals
Operating manual for the high flux isotope reactor. Operating procedures. Part 2, 11:11288 (R;US)
Operation
Operating manual for the high flux isotope reactor. Operating procedures. Part 2, 11:11288 (R;US)
Reactor Experimental Facilities
Thermal reactor design for a neutron scattering source facility, 11:11287 (R;US)
Reactor Maintenance
High Flux Isotope Reactor quarterly report, July-September 1985, 11:11290 (R;US)
Reactor Operation
High Flux Isotope Reactor quarterly report, July-September 1985, 11:11290 (R;US)
Specifications
High Flux Isotope Reactor technical specifications, 11:11289 (R;US)
HIGGS BOSONS
Leptonic Decay
New weak boson decays and possible spin 3/2 leptons, 11:12186 (R;BR)
Particle Identification
Identification of neutral Higgs bosons in the Delphi detector at Lep, 11:12211 (R;SE)
Weak Particle Decay
Anomalous Z^0 decay and a stronger coupled Higgs boson, 11:12185 (R;BR)
HIGGS MODEL
Radiative Corrections
Naturalness for multiscalar models and radiative stability, 11:12263 (J;US)
HIGH BTU GAS
Over 900 Btu/ft^3.
Production
Economic evaluation of methanol and SNG production using UCG, 11:10755 (RA;US)
HIGH ENERGY PHYSICS
Use only for articles of a very broad nature such as an annual research program, etc.
Experiment Planning
Beyond proton decay: other physics possibilities with the Homestake nucleon decay detector, 11:12174 (J;US)
Discussion on a national underground science facility (NUSF), 11:12177 (J;US)
Laboratories
Discussion on a national underground science facility (NUSF), 11:12177 (J;US)
Siting, constructing, and maintaining a deep underground science laboratory, 11:12175 (J;US)

Radiation Detectors
Operational approach to high energy physics detectors at Fermilab, 11:12155 (R;US)
Research Programs
Beyond proton decay: other physics possibilities with the Homestake nucleon decay detector, 11:12174 (J;US)
Discussion on a national underground science facility (NUSF), 11:12177 (J;US)
High energy experimental physics. Progress report and renewal proposal, 11:12145 (R;US)
Social Impact
High energy physics in our society, 11:12139 (R;FR)

HIGH ENERGY RADIOTHERAPY
See RADIOTHERAPY

HIGH EXPLOSIVES
See CHEMICAL EXPLOSIVES

HIGH FLUX ISOTOPE REACTOR
See HFIR REACTOR

HIGH TEMPERATURE GAS COOLED AND GRAPHITE
See HTGR TYPE REACTORS

HIGH-LEVEL RADIOACTIVE WASTES
Encapsulation
Encapsulation of spent nuclear fuel in ceramic materials. An introductory study, 11:11024 (R;SE)
Forecasting
Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1, 11:11005 (R;US)
Inventories
Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1, 11:11005 (R;US)
Packaging
Effect of alpha and gamma radiation on the near-field chemistry and geochemistry of high-level waste packages, 11:11031 (R;US)
How reliable does the waste package containment have to be, 11:11036 (RA;US)
Review of DOE Waste Package Program. Semiannual report, October 1984-March 1985. Volume 8, 11:11025 (R;US)
Radioactive Waste Disposal
Effect of alpha and gamma radiation on the near-field chemistry and geochemistry of high-level waste packages, 11:11031 (R;US)
Evaluation of "Commercial Repository Capacity for the Disposal of Defense High-Level Waste." Response to comments, 11:10999 (R;US)
Objective of the NRC high-level research program at BNL, 11:11054 (J;US)
The radioactive waste disposal problem has a solution - the Waste Isolation Pilot Plant project, 11:11051 (J;US)
Waste Forms
BNL high-level waste technical assistance programs for support of the NRC, 11:11053 (J;US)

HIGHLY ENRICHED URANIUM
80 - 100 per cent.
Nuclear Materials Diversion
The Pajarito Monitor: a high-sensitivity monitoring system for highly enriched uranium, 11:11840 (J;US)

HIGHWAYS
See ROADS

HISTONES
Adducts
Biochemical studies on the mechanism of benzo(a)pyrene binding to cellular macromolecules. Progress report, 11:12007 (R;US)

HOG FUEL
See WOOD WASTES

HOLMIUM
Ion-Atom Collisions
L-shell X-ray production cross sections in Nd, Gd, Ho, Yb, Au and Pb for 25-MeV carbon and 32-MeV oxygen ions, 11:12110 (J;NL)

HOMALITE
Mechanical Properties
Study of energy loss and its mechanisms in Homalite 100 during crack propagation and arrest, 11:11569 (R;US)
Physical Properties
Study of energy loss and its mechanisms in Homalite 100 during crack propagation and arrest, 11:11569 (R;US)

HOPE CREEK-1 REACTOR
Salem, New Jersey, USA. Prior to November 1973 known as Newbold Island-1 Reactor, for the initially planned site and older material is so indexed.
Electrical Equipment
Audit of the environmental qualification of safety-related electrical equipment at the Hope Creek Generating Station (Docket No. 50-354), 11:11305 (R;US)
Engineered Safety Systems
Audit of the environmental qualification of safety-related electrical equipment at the Hope Creek Generating Station (Docket No. 50-354), 11:11305 (R;US)
Reactor Safety
Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, Hope Creek Generating Station (Docket No. 50-354), 11:11306 (R;US)

HOPE CREEK-2 REACTOR
Salem, New Jersey, USA. Prior to November 1973 known as Newbold Island-2 Reactor for the initially planned site, and older material is so indexed.
Electrical Equipment
Audit of the environmental qualification of safety-related electrical equipment at the Hope Creek Generating Station (Docket No. 50-354), 11:11305 (R;US)
Engineered Safety Systems
Audit of the environmental qualification of safety-related electrical equipment at the Hope Creek Generating Station (Docket No. 50-354), 11:11305 (R;US)

HOT PLASMA
Electron Rings
Hot-electron ring formation in tokamak plasmas, 11:12458 (J;US)
Nuclear Reaction Kinetics
Measurement and application of DDsub(γ), DTsub(γ) and D^3Hesub(γ) reactions at low energy, 11:12291 (J;NL)

HOT-DRY-ROCK SYSTEMS
Research Programs
Present status of hot dry rock technology, 11:11201 (R;US)

HOUSES
Decontamination
Phase I decontamination of the J.C. Haynes site, Newark, Ohio. Final report, 11:11004 (R;US)
Indoor Air Pollution
Indoor air quality: sources and control, 11:11873 (J;US)
Modeling and testing of formaldehyde emission characteristics of pressed-wood products. Reports XII, XIII, and XIV to the US Consumer Product Safety Commission, 1985, 11:11868 (R;US)
Monitoring
Data acquisition and testing at the Tennessee Energy Conservation in Housing (TECH) complex, 11:11442 (R;US)
Passive Solar Heating Systems
Parametric studies: Direct-gain windows, conservatories and convective systems, 11:11415 (RA;CH;In German)

HTGR TYPE REACTORS
Design
Small modular HTGR nuclear power plant concept to meet the total energy needs of the developing nations, 11:11257 (R;US)
Power Generation
Small modular HTGR nuclear power plant concept to meet the total energy needs of the developing nations, 11:11257 (R;US)
Process Heat
Small modular HTGR nuclear power plant concept to meet the total energy needs of the developing nations, 11:11257 (R;US)

HTO
See HEAVY WATER
TRITIUM COMPOUNDS

HUGENHOLTZ-PINES THEORY
See HYDROGEN

HUMAN FACTORS ENGINEERING
Human engineering design guidelines for maintainability. Final report, 11:11314 (R;US)
HUNGARIAN PAKS-1 REACTOR
See PAKS-1 REACTOR
HYBRID REACTORS
Gain
Muon catalyzed fusion - fission reactor driven by a recirculating beam, 11:12494 (R;US)
Heavy Ion Fusion Reactions
Muon catalyzed fusion - fission reactor driven by a recirculating beam, 11:12494 (R;US)
HYBRID SYSTEMS
Meetings
IEA Solar Task 8: Passive and hybrid use of solar energy, 11:11185 (R;CH;In German and French)
HYDRATES
For chemical compounds or minerals.
See also GAS HYDRATES
Crystal Structure
Circular and flip-flop hydrogen bonding in β-cyclodextrin undecahydrate: neutron diffraction study, 11:11697 (J;US)
Neutron Diffraction
Circular and flip-flop hydrogen bonding in β-cyclodextrin undecahydrate: neutron diffraction study, 11:11697 (J;US)
HYDRAULIC FRACTURES
Geometry
Stimulation model for lenticular sands: Proppant transport model. Phase I annual report. Final report, 11:10965 (R;US)
Mathematical Models
Stimulation model for lenticular sands: Proppant transport model. Phase I annual report. Final report, 11:10965 (R;US)
HYDRAULIC FRACTURING
Propping Agents
Stimulation model for lenticular sands: Proppant transport model. Phase I annual report. Final report, 11:10965 (R;US)
HYDRAULIC RAMS
See PUMPS
HYDRAZINE
Photochemical Reactions
Assessment of photochemical applications to specific stages in Savannah River Plant actinide reprocessing streams, 11:10988 (R;US)
HYDRIDES
See also IRON HYDRIDES
LITHIUM HYDRIDES
SILANES
TITANIUM HYDRIDES
Moessbauer Effect
Mossbauer studies on LaNi(4.7)Sn(0.3) and its hydride, 11:11411 (R;US)
HYDRIODIC ACID
Chemical Reactions
Gas-phase reactions of atomic chlorine with vinyl chloride, 11:11685 (J;US)
HYDROCARBONS
See also ALKANES
ANTHRACENE
BENZENE
BENZOPYRENE
FLUORENE
NAPHTHALENE
PHENANTHRENE
POLYCYCLIC AROMATIC HYDROCARBONS
PYRENE
STILBENE
TETRALIN
TOLUENE
XYLENES
Combustion
Effect of in-situ heat treatment on coal char reactivity. Ostwald equations and combustion efficiency in hydrocarbon and coal flames. Progress report, 11:10909 (R;US)
Multiple ignition, combustion, and quenching of hydrocarbon fuel sprays. Annual report, July 1983-July 1984, 11:11729 (R;US)
Gas Chromatography
Aspects of high-resolution gas chromatography as applied to the analysis of hydrocarbon fuels and other complex organic mixtures. Volume 2. Survey of sample-insertion techniques. Final report, January-September 1980, 11:11603 (R;US)
Ignition
Multiple ignition, combustion, and quenching of hydrocarbon fuel sprays. Annual report, July 1983-July 1984, 11:11729 (R;US)
Oxidation
Preignition oxidation characteristics of hydrocarbon fuels. Final report, 15 April 1980-14 October 1984, 11:11728 (R;US)
Synthesis
FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report, 11:11130 (R;US)
Yields
FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report, 11:11130 (R;US)
HYDROCHLORIC ACID
Adducts
Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet, 11:12096 (J;US)
Complexes
Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet, 11:12096 (J;US)
Infrared Spectra
Vibrational spectroscopy of van der Waals bonds: Measurement of the perpendicular bend of ArHCl by intracavity far infrared laser spectroscopy of a supersonic jet, 11:12096 (J;US)
Molecular Structure
Structure and thermochemistry of the van der Waals molecule C_6H_6xHCl and its photoion $(C_6H_6xHCl)^+$, 11:11679 (J;US)
Photoionization
Structure and thermochemistry of the van der Waals molecule C_6H_6xHCl and its photoion $(C_6H_6xHCl)^+$, 11:11679 (J;US)
HYDRODYNAMICS
See also MAGNETOHYDRODYNAMICS
Resolution
Resolution of hydrodynamical equations for transverse expansions. Part 1, 11:12130 (R;BR)
Resolution of hydrodynamical equations for transverse expansions. Part 2, 11:12131 (R;BR)
HYDROFLUORIC ACID
Aerosol Monitoring
Sampling, characterization, and remote sensing of aerosols formed in the atmospheric hydrolysis of uranium hexafluoride, 11:11070 (J;US)
Chemical Reactions
Removal of oxide contamination from silicon carbide powders, 11:11565 (J;US)
Toxicity
Toxicity levels to humans during acute exposure to hydrogen fluoride, 11:12008 (R;CA)
HYDROFORMYLATION
See CARBONYLATION
HYDROGEN
Activation Analysis
Activation analysis, 11:11609 (RA;US)
Adsorption
Capabilities of light element surface analysis by nuclear microanalysis, 11:11617 (R;FR;In French)
Adsorption Heat
Metal-support effects on H_2 and CO heats of adsorption on TiO_2-supported platinum, 11:11654 (J;US)
Atom-Molecule Collisions
Effect of bending potential on calculated product-state distributions for the reaction H + D_2 yields HD + D, 11:12059 (R;US)
Variational-transition-state theory with least-action tunneling calculations for the kinetic isotope effects in the Cl+h_2 reaction: tests of extended-leps, information-theoretic, and diatomics-in-molecules potential energy surfaces, 11:12062 (R;US)

Chemisorption
Experimental investigation of the rate of hydrogen absorption in zirconium-2.5 wt percent niobium from steam/hydrogen mixtures at elevated temperatures. Test specifications, 11:11649 (R;CA)
Combustion
Concentration limits of hydrogen ignition in air in mixtures with non-combustible gases under normal circumstances, 11:11735 (RA;XA)
Determination of flame propagation limits in stoichiometric oxyhydrogen mixtures with steam, 11:11738 (RA;XA)
Detonation characteristics of hydrogenous mixtures, 11:11736 (RA;XA)
Theoretical evaluation of critical gas layer thickness in relation to detonation wave propagation, 11:11737 (RA;XA)
Compression
Performance results from the Hydrogen Technology Evaluation Center at Brookhaven National Laboratory, 11:11119 (R;US)
Consumption Rates
LRC liquefaction reducing gas composition and moisture effects product yield, quality and operability, 11:10740 (RA;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Control
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)
Dissociation
ESR study of the dissociation of hydroxyl protons in hydroxycyclohexadienyl radicals, 11:11691 (J;US)
Distillation
Technical and economical feasibility studies and preliminary plan of a heavy water plant by the cryogenic distillation method of hydrogen, 11:11111 (R;CL;In Spanish)
Excitation
nlm→n'l'm' transition polarizability, magnetizability and susceptibilities for H atom, 11:12082 (R;IT)
Explosions
Theoretical evaluation of critical gas layer thickness in relation to detonation wave propagation, 11:11737 (RA;XA)
Fire Hazards
Basis for safety standards aimed at averting fire and explosion hazards during work involving hydrogen, 11:11739 (RA;XA)
G Value
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)
Observations regarding the stability of bentonite backfill in a high-level waste (HLW) repository in rock salt, 11:11585 (R;US)
Hadronic Atoms
Influence of quark configurations on the spectrum of the hadronic atom, 11:12085 (R;SU)
Harmonic Oscillator Models
Constraint quantization: case of the hydrogen atom, 11:12089 (R;FR;In French)
Ion-Atom Collisions
Electron capture to the continuum from atomic hydrogen, 11:12109 (J;NL)
Ion-Molecule Collisions
Electron capture to the continuum from atomic hydrogen, 11:12109 (J;NL)
Magnetic Susceptibility
nlm→n'l'm' transition polarizability, magnetizability and susceptibilities for H atom, 11:12082 (R;IT)
Meetings
Hydrogen behaviour and control and related containment loading aspects. Proceedings of a specialists' meeting organized by the IAEA and held in Suzdal, USSR, 19-23 September 1983, 11:11644 (R;AT)
Molecule-Molecule Collisions
State-to-state vibrational excitation of I_2 in collisions with H_2 and D_2, 11:12098 (J;US)
Nuclear Magnetic Resonance
Direct spectroscopic observation of molecular hydrogen by high resolution proton NMR and a reinterpretation of the proton NMR spectra for amorphous Si:H, 11:11575 (R;FR)
Photoacoustic Spectroscopy
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)
Photochemistry
Photoluminescent response of palladium-cadmium sulfide and palladium-graded cadmium sulfoselenide Schottky diodes to molecular hydrogen. Technical report, 11:11571 (R;US)
Photolysis
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
Polarizability
nlm→n'l'm' transition polarizability, magnetizability and susceptibilities for H atom, 11:12082 (R;IT)
Proton Reactions
Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)
Recombination
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)
Zeeman Effect
Zeeman effect in highly excited atoms: 2. Three-dimensional case, 11:12093 (R;BR)

HYDROGEN 1 TARGET
Antiproton Reactions
Antiproton-nucleon physics at LEAR, 11:12284 (R;FR;In French)
Deuteron Reactions
Polarization in three-nucleon breakup: Experiment and theory, 11:12289 (J;NL)

HYDROGEN 2
See DEUTERIUM

HYDROGEN 3
See TRITIUM

HYDROGEN 4
Energy Levels
Existence of ^4H resonances, 11:12286 (R;SU)

HYDROGEN BURNING
Astrophysical processes only.
Nuclear Reaction Kinetics
Low-energy nuclear reactions with hydrogen isotopes, 11:12290 (J;NL)

HYDROGEN CHLORIDES
See HYDROCHLORIC ACID

HYDROGEN DONOR REACTIONS
See HYDROGEN TRANSFER

HYDROGEN FLUORIDES
See HYDROFLUORIC ACID

HYDROGEN HYDROXIDES
See WATER

HYDROGEN IODIDES
See HYDRIODIC ACID

HYDROGEN IONS 1 PLUS
For H_1^+ ions.
Collisions
Atomic effects of electrons and protons at low energies, 11:12066 (R;US)

HYDROGEN PRODUCTION
Electrolysis
Performance results from the Hydrogen Technology Evaluation Center at Brookhaven National Laboratory, 11:11119 (R;US)
Photovoltaic-powered solid polymer electrolyte (SPE) electrolyzer system evaluation. Final report, 11:11120 (R;US)
Products found in the anodic oxidation of coal, 11:11122 (J;GB)
Research Programs
Hawaii Natural Energy Institute annual report, 1984, 11:11384 (R;US)
Solar Energy
Solar thermochemical hydrogen: the heat source-process interface, 11:11123 (J;GB)

Thermochemical Processes
Hydrogen and sulfur from hydrogen sulfide-4. Quenching the effluent from a solar furnace, 11:11121 (J;GB;RU)
Solar thermochemical hydrogen: the heat source-process interface, 11:11123 (J;GB)
HYDROGEN STORAGE
Research Programs
Hawaii Natural Energy Institute annual report, 1984, 11:11384 (R;US)
HYDROGEN SULFIDES
Electrochemistry
Determination of gaseous hydrogen sulfide by cathodic stripping voltammetry after preconcentration on a silver metalized porous membrane electrode, 11:11602 (R;US)
Quenching
Hydrogen and sulfur from hydrogen sulfide-4. Quenching the effluent from a solar furnace, 11:11121 (J;GB;RU)
Removal
Alkaline and Stretford scrubbing tests for H_2S removal from in-situ oil retort offgas. Final report, February 1983-February 1985, 11:10968 (R;US)
Voltametry
Determination of gaseous hydrogen sulfide by cathodic stripping voltammetry after preconcentration on a silver metalized porous membrane electrode, 11:11602 (R;US)
HYDROGEN TRANSFER
Measuring Methods
Determination of radical initiating and hydrogen donating properties of coal liquefaction process solvents by reaction with fluorenone (Reduction of fluorenone to fluorene by coal liquefaction process solvents), 11:10792 (R;US)
HYDROGENATION
Catalysts
Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Two-stage liquefaction catalyst evaluation. Final report, 11:10789 (R;US)
HYDRONIUM IONS
See OXONIUM IONS
HYDROXYBENZENE
See PHENOL
HYDROXYL IONS
See ANIONS
HYDROXYL RADICALS
Affinity
Electron affinity of hydroxyl radical, 11:12101 (J;US)
Electronegativity
Electron affinity of hydroxyl radical, 11:12101 (J;US)
HYDROXYLAMINE
Photochemical Reactions
Assessment of photochemical applications to specific stages in Savannah River Plant actinide reprocessing streams, 11:10988 (R;US)
HYDROXYLASE
See HYDROXYLASES
HYDROXYLASES
Code number 1.14
Tissue Distribution
Intracellular localization of hydroxyproline-rich glycoprotein biosynthesis, 11:11930 (RA;US)
HYDROXYPROLINE
Biochemistry
Intracellular localization of hydroxyproline-rich glycoprotein biosynthesis, 11:11930 (RA;US)
Biosynthesis
Hydroxyproline synthesis is required for cell wall regeneration, 11:11935 (RA;US)
HYDROXYTOLUENES
See CRESOLS
HYGAS PROCESS
Ashes
Crystallization behavior of coal gasification ash, 11:10805 (J;US)
HYPERFRAGMENTS
See HYPERNUCLEI
HYPERNUCLEI
Energy-Level Transitions
Hypernuclear gamma rays, 11:12036 (R;US)
Symmetry Breaking
Few-body strange systems, 11:12372 (R;US)
Three-Body Problem
Few-body strange systems, 11:12372 (R;US)
HYPERONS
See also LAMBDA PARTICLES
Particle Production
Quasifree production of hyperons from nuclei, 11:12359 (R;US)

I

ICRP
Radiation Protection
Preliminary radiation protection tests for the body height and body weight of the Chinese reference man, 11:12394 (TG;US)
IDAHO NATIONAL ENGINEERING LABORATORY
Prior to 1976 known as NRTS and older material is so indexed.
Radioactive Waste Disposal
Long-range plan for buried transuranic waste studies at the Idaho National Engineering Laboratory, 11:11011 (R;US)
Radioactive Waste Management
Management of TRU waste at the Idaho National Engineering Laboratory, 11:11049 (J;US)
IDEAL FLOW
Numerical Solution
Vortex method for flows with slight density variations, 11:12134 (J;US)
IGNITION
Catalysts
Criteria for ignition in monopropellant engines, 11:11780 (R;US)
IGT HYDROGASIFICATION PROCESS
See HYGAS PROCESS
ILLINOIS
Nuclear Power
Nuclear power in the Midwest: proceedings of the twelfth annual Illinois Energy Conference, 11:11390 (R;US)
ILLUMINATION SYSTEMS
See LIGHTING SYSTEMS
IMAGE INTENSIFIERS
Illuminance
Laser-illuminated nano-second microscope, 11:11754 (J;US)
IMMOBILIZED CELLS
Performance Testing
Conversion of food processing wastes into ethanol using a novel biological reactor/separator. Final report, September 1, 1984-September 30, 1985, 11:11139 (R;US)
IMPERMEABLE DRY ROCK
See HOT-DRY-ROCK SYSTEMS
IMPURITIES
Unwanted constituents, not for TRACE AMOUNTS, INTERFERING ELEMENTS, or metal and nonmetal additions.
Transport
Some effects of MHD activity on impurity transport in the PBX tokamak, 11:12448 (R;US)
IN CORE INSTRUMENTS
See also specific instruments plus FUEL ASSEMBLIES or REACTOR CORES.
Fast reactor status review. Development work on core protective instrumentation, 11:11358 (TJ;GB)
Response Functions
Use of fuel-thermocouple scram response for data verification, 11:11237 (R;US)
IN UTERO IRRADIATION
See PRENATAL IRRADIATION
INCINERATION
See COMBUSTION

INCINERATORS
Fluidized-Bed Combustors
Investigation of fluid-bed combustion of municipal solid waste, 11:11483 (R;US)
Waste Heat Utilization
Energy recovery from existing municipal incinerators. Final report, 11:11479 (R;US)
INCLUSION COMPLEXES
See CLATHRATES
INCLUSIVE DISTRIBUTION
See INCLUSIVE INTERACTIONS
INCLUSIVE INTERACTIONS
Quantum Chromodynamics
Evolution kernels in QCD: two-loop calculation in the Feynman gauge, 11:12249 (R;SU;In Russian)
Structure Functions
Effective cross section matrix and the isotopic relations between the structure functions of inclusive processes, 11:12204 (R;SU;In Russian)
Total Cross Sections
Effective cross section matrix and the isotopic relations between the structure functions of inclusive processes, 11:12204 (R;SU;In Russian)
INCOLOY 800H
Strain Rate
Summary of recent research on mechanical behavior of polycrystalline solids. Progress report, March 1985-March 1986, 11:11512 (R;US)
Stress Relaxation
Summary of recent research on mechanical behavior of polycrystalline solids. Progress report, March 1985-March 1986, 11:11512 (R;US)
INCOMPRESSIBLE FLOW
Numerical Solution
Vortex method for flows with slight density variations, 11:12134 (J;US)
INDIA
Wind Power
Potential of wind energy in Rajasthan state (India): a case study, 11:11204 (RA;PR)
INDIAN RESERVATIONS
Energy Source Development
Program and financial report on Department of Energy, 11:11385 (R;US)
Resource Development
Program and financial report on Department of Energy, 11:11385 (R;US)
INDIANS (AMERICAN)
See AMERICAN INDIANS
INDIUM 111
Isotope Production
Simple method of ^{111}In high temperature isolation from silver, 11:11720 (R;SU;In Russian)
Separation Processes
Simple method of ^{111}In high temperature isolation from silver, 11:11720 (R;SU;In Russian)
INDIUM 115 TARGET
Neutron Reactions
Neutron-capture cross-section measurements for ^{115}In and ^{197}Au in the energy region 2.0-7.7 MeV, using the activation technique, 11:12331 (R;SE)
INDIUM ARSENIDES
Magneto-Optical Effects
Pressure-dependent magneto-optic measurements in strained-layer superlattices at low temperatures, 11:11586 (R;US)
Superlattices
Optical imaging of dislocations in strained-layer superlattices and lattice-mismatched epilayers, 11:11588 (R;US)
INDIUM BROMIDES
Crystal Structure
Structure of 3,4;3',4'-bis(ethylenedithio)-2,2',5,5'-tetrathiafulvalent-tetrabromoindate (2:1), (BEDT-TTF)$_2$InBr$_4$, ($C_{10}H_8S_8$)$_2$InBr$_4$, 11:11601 (J;DK)
INDIUM OXIDES
Surface Coating
Indium tin oxide/gallium arsenide solar cells, 11:11171 (J;US)
INDOLES
Mutagenesis
Mutagen formation in a model beef boiling system. III. Purification and identification of three heterocyclic amine mutagens-carcinogens, 11:12011 (J;US)
INDONESIA
Energy Policy
Indonesia - energy situation 1983/1984, 11:11395 (R;DE;In German)
Energy Supplies
Indonesia - energy situation 1983/1984, 11:11395 (R;DE;In German)
INDOOR AIR POLLUTION
Pollutants
Indoor air quality: sources and control, 11:11873 (J;US)
Pollution Sources
Formaldehyde emissions from fibrous glass insulation products, 11:11865 (R;US)
Radon 222
Indoor air quality: sources and control, 11:11873 (J;US)
Research Programs
Progress in indoor radon measurement. Review of previous research (July 1981-February 1985), 11:11881 (R;US)
Ventilation
Development of statistical distributions or ranges of standard factors used in exposure assessments. Final report, 11:12026 (R;US)
INDUCED RADIOACTIVITY
See RADIOACTIVITY
INDUSTRIAL PLANTS
See also COAL GASIFICATION PLANTS
COAL LIQUEFACTION PLANTS
COAL PREPARATION PLANTS
ETHANOL PLANTS
METHANOL PLANTS
PETROLEUM REFINERIES
SYNTHETIC FUELS REFINERIES
Fuel Substitution
Industrial wood energy feasibility studies, 11:11149 (RA;PR)
Heat Recovery
Heat recovery in an air-breakdown system with the use of waste heat for indoor heating and industrial heat, 11:11472 (RA;DE;In German)
Solar Water Heating
Potential applications of solar energy in the Republic of Panama, 11:11179 (RA;PR)
Waste Heat Utilization
Heat recovery in an air-breakdown system with the use of waste heat for indoor heating and industrial heat, 11:11472 (RA;DE;In German)
INDUSTRIAL SECTOR
See INDUSTRY
INDUSTRIAL WASTES
See also SPENT LIQUORS
Environmental Effects
Oil in the sea: inputs, fates, and effects. Final report, 11:10941 (R;US)
Fermentation
Use of appropriate technologies for biomass waste conversion in small communities, 11:11126 (RA;PR)
Leaching
Mobility of organic and inorganic constituents from energy and combustion-related wastes under codisposal conditions, 11:11484 (J;US)
INDUSTRY
See also AGRICULTURE
AUTOMOTIVE INDUSTRY
CHEMICAL INDUSTRY
FOOD INDUSTRY
NUCLEAR INDUSTRY
TEXTILE INDUSTRY
WOOD PRODUCTS INDUSTRY
Computerized Control Systems
Optimisation of large-scale industrial refrigeration, 11:11470 (RA;DE;In German)
Natural Gas
Most efficient way of transforming natural gas into heat, cooling and electricity, 11:11471 (RA;DE;In German)

Refrigerators
Optimisation of large-scale industrial refrigeration, 11:11470 (RA;DE;In German)
INERTIAL CONFINEMENT
A dynamic plasma confinement by inertial forces.
Research Programs
Laser Program annual report 1984, 11:12505 (R;US)
INFECTIOUS DISEASES
See also FUNGAL DISEASES
Pathology
Radiometric methods for rapid diagnosis of viral infection. Annual report, 1 February 1976-31 January 1977, 11:11984 (R;US)
INFORMATION CENTERS
Research Programs
Carbon Dioxide Information Center FY 1985 progress report, 11:11867 (R;US)
INFORMATION SYSTEMS
Meetings
Reliability of fossil-fuel and nuclear power installations, 11:11243 (R;CS;In Czech, Slovak, German and Russian)
Reliability
Reliability of fossil-fuel and nuclear power installations, 11:11243 (R;CS;In Czech, Slovak, German and Russian)
INHALATION EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS
INHOMOGENEOUS PLASMA
Wave Propagation
Effect of toroidicity during lower hybrid mode conversion, 11:12433 (R;US)
INITIAL RESERVOIR PRESSURE
See RESERVOIR PRESSURE
INJECTION WELLS
Cooling Systems
Models of the thermal state in an underground gasification well, 11:10766 (RA;US)
Temperature Control
Models of the thermal state in an underground gasification well, 11:10766 (RA;US)
Well Servicing
Status of the joint Belgo-German experiment of underground coal gasification, 11:10745 (RA;US)
INORGANIC ION EXCHANGERS
See also ZEOLITES
Separation and purification of fission products from process streams of irradiated nuclear fuel, 11:11022 (RA;XA)
Chemical Properties
Fundamental properties of acid salts of tetravalent metals and some considerations on the perspectives of their application in nuclear technology, 11:11646 (RA;XA)
Ion-exchange selectivities on antimonic acids and metal antimonates, 11:11648 (RA;XA)
Studies on inorganic ion exchangers. Fundamental properties and application in nuclear energy programmes, 11:11647 (RA;XA)
Synthetic inorganic ion exchangers and their potential use in the nuclear fuel cycle, 11:11645 (RA;XA)
Chemical Radiation Effects
Effect of gamma radiation on various inorganic ion exchangers, 11:11712 (RA;XA)
Uses
Fundamental properties of acid salts of tetravalent metals and some considerations on the perspectives of their application in nuclear technology, 11:11646 (RA;XA)
Studies on inorganic ion exchangers. Fundamental properties and application in nuclear energy programmes, 11:11647 (RA;XA)
Synthetic inorganic ion exchangers and their potential use in the nuclear fuel cycle, 11:11645 (RA;XA)
INPUT WELL
See INJECTION WELLS
IN-SITU GASIFICATION
Borehole Linking
Influence of H_2O at high PT-conditions upon the volumetric and mobility behavior of bituminous coal for in-situ-gasification after linking-process, 11:10761 (RA;US)
Oxidation kinetics and models for self ignition of coal in underground gasification, 11:10768 (RA;US)
Proven directional drilling techniques tested in Texas lignite, 11:10748 (RA;US)
Self-ignition and reverse combustion setting of operating conditions for the Haute Deule site test, 11:10753 (RA;US)
Simulation of UCG in great depth, 11:10760 (RA;US)
Theoretical and experimental studies of reverse combustion, 11:10763 (RA;US)
UCG tests at la Haute-Deule - first results, 11:10747 (RA;US)
What can be learned from linking tests at great depth?, 11:10775 (RA;US)
Catalysis
Experimental study of coal ash catalyzed reactions between carbon monoxide and hydrogen, 11:10759 (RA;US)
Cavities
Modeling of 2-D cavity growth using continuously deforming finite elements, 11:10774 (RA;US)
Overview of hygrothermomechanical response modeling associated with underground coal conversion, 11:10773 (RA;US)
Combustion Kinetics
Theoretical and experimental studies of reverse combustion, 11:10763 (RA;US)
Combustion Properties
Use of laboratory combustion tube data in monitoring and designing UCG field tests, 11:10752 (RA;US)
Combustion Waves
Analysis of early cavity growth in underground coal gasification, 11:10767 (RA;US)
Theoretical and experimental studies of reverse combustion, 11:10763 (RA;US)
Commercialization
GRI perspective on UCG as an SNG supply option, 11:10757 (RA;US)
UCG - derived synthesis gas: an economic comparison, 11:10758 (RA;US)
Underground coal gasification commercialization concepts, 11:10756 (RA;US)
Computerized Simulation
Sweep efficiency model for underground coal gasification, 11:10769 (RA;US)
Coordinated Research Programs
What can be learned from linking tests at great depth?, 11:10775 (RA;US)
Crack Propagation
Parametric study of a simplified model of coal face spalling, 11:10771 (RA;US)
Economic Analysis
Critical economic parameters for underground coal gasification, 11:10916 (RA;US)
Economic evaluation of methanol and SNG production using UCG, 11:10755 (RA;US)
GRI perspective on UCG as an SNG supply option, 11:10757 (RA;US)
Electrolinking
Modeling and experimental studies of electrolinking, 11:10764 (RA;US)
Environmental Effects
Techniques used in the determination of the areal extent of organic contamination at the US DOE Hoe Creek underground gasification site, 11:10808 (RA;US)
Environmental Impacts
Site characterization and environmental monitoring approach for UCG research and development in bituminous coals, 11:10809 (RA;US)
Feasibility Studies
Excavation evaluation of the controlled burnout of an abandoned coal mine, 11:10776 (RA;US)
Industry's role in exporting UCG technology, 11:11397 (RA;US)
Results of the Centralia underground coal gasification field test, 11:10744 (RA;US)
Field Tests
Next phase of WIDCO's Tono project, 11:10777 (RA;US)

Results of the Centralia underground coal gasification field test, 11:10744 (RA;US)
UCG tests at la Haute-Deule - first results, 11:10747 (RA;US)
WIDCO Partial Seam CRIP test: impact of gas characteristics on processing requirements, 11:10750 (RA;US)
Fluid Flow
Modeling and experimental studies of electrolinking, 11:10764 (RA;US)
Results from a laboratory flow model for a UCG cavity, 11:10762 (RA;US)
Fluid Mechanics
Results from a laboratory flow model for a UCG cavity, 11:10762 (RA;US)
Gas Condensates
Biotreatment of UCG condensate and pattern water, 11:10765 (RA;US)
Ground Subsidence
Subsidence modeling of Rawlins underground coal gasification Tests 1 and 2, 11:10772 (RA;US)
Heat Losses
Use of post-burn coring data from the Hanna III field test to infer the spalling characteristics, water influx and heat losses, 11:10770 (RA;US)
Heat Transfer
Heat exchange effects during underground gasification of thin coal layers, 11:10754 (RA;US)
Injection Wells
Models of the thermal state in an underground gasification well, 11:10766 (RA;US)
Mechanical Properties
Overview of hygrothermomechanical response modeling associated with underground coal conversion, 11:10773 (RA;US)
Operating Cost
GRI perspective on UCG as an SNG supply option, 11:10757 (RA;US)
Power Generation
Underground coal gasification commercialization concepts, 11:10756 (RA;US)
Prevention of Significant Deterioration
Site characterization and environmental monitoring approach for UCG research and development in bituminous coals, 11:10809 (RA;US)
Research Programs
Description and status of the Byrne Creek power project, 11:10746 (RA;US)
Excavation evaluation of the controlled burnout of an abandoned coal mine, 11:10776 (RA;US)
Geotechnical studies on the overburden rock from the Hanna IV UCG site, 11:10751 (RA;US)
GRI perspective on UCG as an SNG supply option, 11:10757 (RA;US)
Next phase of WIDCO's Tono project, 11:10777 (RA;US)
Preliminary results of postburn coring and drilling at WIDCo-CRIP UCG experimental test site, Centralia, Washington, 11:10749 (RA;US)
Self-ignition and reverse combustion setting of operating conditions for the Haute Deule site test, 11:10753 (RA;US)
Simulation of UCG in great depth, 11:10760 (RA;US)
Status of the joint Belgo-German experiment of underground coal gasification, 11:10745 (RA;US)
UCG tests at la Haute-Deule - first results, 11:10747 (RA;US)
Use of laboratory combustion tube data in monitoring and designing UCG field tests, 11:10752 (RA;US)
Use of post-burn coring data from the Hanna III field test to infer the spalling characteristics, water influx and heat losses, 11:10770 (RA;US)
Utilization of non-mineable coal - a new approach of German coal industry, 11:10743 (RA;US)
WIDCO Partial Seam CRIP test: impact of gas characteristics on processing requirements, 11:10750 (RA;US)
Spontaneous Combustion
Self-ignition and reverse combustion setting of operating conditions for the Haute Deule site test, 11:10753 (RA;US)
Simulation of UCG in great depth, 11:10760 (RA;US)
Strata Movement
Parametric study of a simplified model of coal face spalling, 11:10771 (RA;US)
Sweep Efficiency
Sweep efficiency model for underground coal gasification, 11:10769 (RA;US)
Synthetic Fuels
Description and status of the Byrne Creek power project, 11:10746 (RA;US)
Technology Transfer
Industry's role in exporting UCG technology, 11:11397 (RA;US)
Technology Utilization
Industry's role in exporting UCG technology, 11:11397 (RA;US)
Thermodynamic Properties
Results from a laboratory flow model for a UCG cavity, 11:10762 (RA;US)
Waste Water
Biotreatment of UCG condensate and pattern water, 11:10765 (RA;US)
Water Influx
Use of post-burn coring data from the Hanna III field test to infer the spalling characteristics, water influx and heat losses, 11:10770 (RA;US)

IN-SITU LIQUEFACTION
Research Programs
Utilization of non-mineable coal - a new approach of German coal industry, 11:10743 (RA;US)

IN-SITU RETORTING
Scrubbers
Alkaline and Stretford scrubbing tests for H_2S removal from in-situ oil retort offgas. Final report, February 1983-February 1985, 11:10968 (R;US)

INSULATING LIMITERS
See LIMITERS

INSULATING OILS
Performance Testing
Characteristics of insulating oil for electrical applications. Volume 2. Effect of copper and aluminum on two types of paraffinic insulating oils. Final report, 11:11773 (R;US)
Characteristics of insulating oil for electrical applications. Volume 1. Evaluation of insulating oils for use in transformers, capacitors, and cables. Final report, 11:11772 (R;US)

INSULATION (THERMAL)
See THERMAL INSULATION

INTENSIFIERS (IMAGE)
See IMAGE INTENSIFIERS

INTERCALATES
See CLATHRATES

INTERCONNECTED POWER SYSTEMS
Control
Information structures for the control of large scale systems. Final technical report, September 1980-March 1984, 11:11210 (R;US)
Information Systems
Information structures for the control of large scale systems. Final technical report, September 1980-March 1984, 11:11210 (R;US)

INTEREST GROUPS
Organizational Models
Emergence of interest groups on hazardous waste siting: how do they form and survive, 11:11389 (R;US)

INTERFACES
Rayleigh-Taylor Instability
Rayleigh—Taylor stability for a normal shock wave—density discontinuity interaction, 11:12133 (J;US)

INTERMEDIATE VECTOR BOSONS
Leptonic Decay
Effects of anomalous Zsup(O) decays on neutrino counting near the Zsup(O), 11:12255 (R;CA)

INTERNAL COMBUSTION ENGINES
See also DIESEL ENGINES
GAS TURBINE ENGINES

Methanol Fuels
Waste heat recovery in a 1600 cc methanol fueled engine, 11:11488 (R;US)
Waste Heat Utilization
Waste heat recovery in a 1600 cc methanol fueled engine, 11:11488 (R;US)
INTERNATIONAL COMMISSION RADIOLOGICAL PRO
See ICRP
INTERNATIONAL NUCLEAR DATA COMMITTEE
Information Needs
Planning for the REAL-84 project on adjustment procedures. Report of an IAEA consultants' meeting held in Hamburg, Federal Republic of Germany, 26 September 1984, 11:11924 (R;XA)
Meetings
Proceedings of the 1982 seminar on nuclear data, 11:12279 (R;JP;JA)
Reviews
INDC list of correspondents for the exchange of nuclear data information and compilation of National Nuclear Data Committees, 11:12271 (R;XA)
Report of the Nuclear Data Section to the International Nuclear Data Committee March 1983 - August 1984, 11:12270 (R;XA)
INTERSECTING BEAMS
See COLLIDING BEAMS
INTERSTELLAR SPACE
Astrophysics
Astrophysics. Volume 2. Interstellar matter and galaxies (Text book), 11:12050 (B;US)
INTRANUCLEAR CASCADES
See NUCLEAR CASCADES
INTRUSION
Reporting Requirements
Proposed Revision 1 to Regulatory Guide 5.62: reporting of physical security events. Draft regulatory guide and value/impact statement, 11:11264 (R;US)
INVISCID FLOW
See IDEAL FLOW
IODINE
Adsorption
Application of silver-free zeolites to remove iodine from dissolver off-gases in spent fuel reprocessing plants, 11:11021 (RA;XA)
Molecule-Molecule Collisions
State-to-state vibrational excitation of I_2 in collisions with H_2 and D_2, 11:12098 (J;US)
Separation Processes
Application of silver-free zeolites to remove iodine from dissolver off-gases in spent fuel reprocessing plants, 11:11021 (RA;XA)
IODINE 131
Biological Accumulation
Assimilation and biological turnover of cesium-134, iodine-131, and chromium-51 in brown crickets, Acheta domesticus (L.), 11:12013 (J;US)
Radiation Hazards
Internal emitter limits for iodine, radium and radon daughters, 11:12002 (BA;US)
Translocation
Comparison of predictions from internationally recognized assessment models for the transfer of selected radionuclides through terrestrial food chains, 11:11904 (J;US)
IODINE IODIDES
See IODINE
IODINE ISOTOPES
See also IODINE 131
Decay
Report on CFRMF fission product loop study, 11:12329 (R;US)
ION BEAMS
Beam Bunching
Electromagnetic instabilities and gyrophase-bunched particles, 11:12057 (J;US)
Beam Extraction
Positive heavy-ion sources, 11:12121 (BA;US)
Focusing
Positive heavy-ion sources, 11:12121 (BA;US)
Instability
Beam breakup and the conceptual design of guided and unguided accelerators, 11:11791 (R;US)
Mass Spectroscopy
Microbeam studies, 11:11847 (RA;US)
Plasma Instability
Electromagnetic instabilities and gyrophase-bunched particles, 11:12057 (J;US)
Production
Positive heavy-ion sources, 11:12121 (BA;US)
ION COLLISIONS
See also ELECTRON-ION COLLISIONS
ION-ATOM COLLISIONS
ION-MOLECULE COLLISIONS
PHOTON-ION COLLISIONS
Bremsstrahlung
Atomic effects of electrons and protons at low energies, 11:12066 (R;US)
Electron Emission
Convoy electron production by heavy ions in solids, 11:12113 (J;NL)
Excitation
Final-charge-state-dependence in the production of foil-excited heavy Rydberg atoms, 11:12117 (J;NL)
Ionization
Atomic effects of electrons and protons at low energies, 11:12066 (R;US)
Sputtering
Mechanisms of excitation and ionization processes in sputtering. Final report, 1 September 1981-28 February 1985, 11:12060 (R;US)
ION SOURCES
Beam Neutralization
Current neutralization of intense light ion beams in argon gas, 11:12502 (R;US)
Mass Spectroscopy
Mass spectrometry of inductively coupled plasmas, 11:11624 (J;US)
Quantitative Chemical Analysis
Mass spectrometry of inductively coupled plasmas, 11:11624 (J;US)
Reviews
Positive heavy-ion sources, 11:12121 (BA;US)
Specifications
Polarized ^{3}He ion source for the Van de Graaff based on the 2^3S_1 state of helium. Progress report, 11:11803 (R;CA;In French)
Synchrotron Radiation
Synchrotron radiation production and trapping of highly charged ions, 11:12112 (J;NL)
ION-ATOM COLLISIONS
Electron Capture
Production of projectile and target K X-rays by single and multiple electron capture in collisions of Si^{14+} and Si^{13+} ions with argon atoms at 4.5 and 5.5 MeV/amu, 11:12064 (R;FR)
Electron Emission
Convoy electron production by heavy ions in solids, 11:12113 (J;NL)
Inner-Shell Ionization
Theory of Ksup(n)Lsup(ν) multiple vacancy production by heavy ions, 11:12102 (J;NL)
Research Programs
Negative ion detachment cross sections. Progress report, March 1, 1985-February 28, 1986, 11:12068 (R;US)
X-Ray Spectra
Spectroscopy of quasimolecular X-rays with H-like decelerated ions, 11:12105 (J;NL)
IONIC REACTIONS
See CHEMICAL REACTIONS
IONS
IONIZATION
Cross Sections
Ionization from the sublevels nl with n = 5 and 6 in highly charged ions, 11:12125 (J;GB)

IONIZATION CALORIMETERS
See SHOWER COUNTERS

IONIZING RADIATIONS
See also COSMIC RADIATION
GAMMA RADIATION
Dosimetry
Dosimetric aspects, 11:12003 (BA;US)
Radiation Hazards
Scientific Committee 71 on radiation exposure and potentially-related injury, 11:12004 (BA;US)

ION-MOLECULE COLLISIONS
Charge Exchange
Fine structure effect on the charge transfer reaction of $Ar^+(^2P_3/sub\ //_2/sub\ ,/_1/sub\ //_2)+N_2(X\ ^1\Sigma^+/sub\ g/\ ,v=0)$, 11:12099 (J;US)
Research Programs
Negative ion detachment cross sections. Progress report, March 1, 1985-February 28, 1986, 11:12068 (R;US)

IONOSPHERE
Electron Plasma Waves
Characteristics of short distance field of a source radiating at electronic frequencies in a ionospheric plasma. Applications to density and electron temperature measurement by mutual impedance probe, 11:12056 (R;FR;In French)
Plasma Diagnostics
Characteristics of short distance field of a source radiating at electronic frequencies in a ionospheric plasma. Applications to density and electron temperature measurement by mutual impedance probe, 11:12056 (R;FR;In French)
Plasma Drift
Behavior of ionized plasma in the high latitude topside ionosphere. Memorandum report, 11:12054 (R;US)

IONS
Ions in solutions are indexed as compounds; ions in gases by the precoordinated descriptor consisting of the element name and the term ions; ions in beams by assigning either the specific name if available, e.g. ARGON 40 BEAMS
See also ALUMINIUM IONS
ANIONS
ARGON IONS
CARBON IONS
CATIONS
CHLORINE IONS
CHROMIUM IONS
COBALT IONS
COPPER IONS
FLUORINE IONS
GOLD IONS
HEAVY IONS
HELIUM IONS
KRYPTON IONS
LITHIUM IONS
MAGNESIUM IONS
MANGANESE IONS
MULTICHARGED IONS
NEON IONS
OXYGEN IONS
SILICON IONS
SULFUR IONS
URANIUM IONS
ZINC IONS
Chemical Reactions
Interaction of uranyl ions in carbonate media, 11:11727 (J;NL)

IOTA-1440 RESONANCES
Partial Waves
Partial wave analysis of KKPI system in D and E/IOTA region, 11:12140 (R;US)

IRIDIUM 191
Diagnostic Uses
Detection and quantitation of left-to-right shunting by iridium-191m angiography, 11:11717 (R;US)
Radioisotope Generators
Detection and quantitation of left-to-right shunting by iridium-191m angiography, 11:11717 (R;US)

IRON
See also IRON-GAMMA
Auger Effect
Technique for comparing AES signals from different spectrometers using common materials, 11:11621 (R;US)
Catalytic Effects
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985, 11:11142 (R;US)
Chemical Bonds
Some considerations about bond indices in non-orthogonal bases and the MO calculation of valence and oxidation number, 11:11641 (R;BR)
Electron Diffraction
Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
Epitaxy
Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
Evaporation
Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
Ion Implantation
Binary and ternary amorphous alloys of ion-implanted Fe-Ti-C, 11:11527 (R;US)
Photoelectron Spectroscopy
Transition metal-isocyanide bonding: Photoelectron spectroscopic study of iron tetracarbonyl isocyanide complexes, 11:11659 (J;US)
Reduction
Moessbauer study of the kinetics of Fe^{0*} photoreduction on TiO_2 semiconductor powders, 11:11704 (J;US)
Spin Waves
Prediction of high-energy spin-wave excitation in iron, 11:11533 (J;US)
Valence
Some considerations about bond indices in non-orthogonal bases and the MO calculation of valence and oxidation number, 11:11641 (R;BR)

IRON 54 TARGET
Carbon 12 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
Nickel 58 Reactions
Measurement of the ionization probability of the 1s sigma molecular orbital in half a collision at zero impact parameter, 11:12317 (R;FR)

IRON 56
Structure Functions
Multiquark states in nuclei and the deep inelastic scattering, 11:12370 (R;SU)

IRON 56 TARGET
Carbon 12 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
Neon 20 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)

IRON 57
Moessbauer Effect
Temperature dependence of the ^{57}Fe hyperfine magnetic field distribution in Fe-Ni, 11:11522 (R;US)

IRON 57 TARGET
Carbon 12 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)

IRON 60
Half-Life
Half-life of ^{60}Fe, 11:11726 (J;NL)

IRON ALLOYS
See also IRON BASE ALLOYS
Hydridation
Irreversible effects in the FeTi-H system, 11:11567 (J;CH)
Magnetic Fields
Temperature dependence of the ^{57}Fe hyperfine magnetic field distribution in Fe-Ni, 11:11522 (R;US)

IRON BASE ALLOYS
See also STEELS
Creep
Creep-rupture behavior of iron superalloys in high-pressure hydrogen, 11:11516 (R;US)

Mechanical Properties
Creep rupture behavior of Stirling engine materials (Iron-base NASAUT 4G-Al), 11:11517 (R;US)
IRON CARBIDES
Phase Studies
Binary and ternary amorphous alloys of ion-implanted Fe-Ti-C, 11:11527 (R;US)
IRON CHLORIDES
Photochemical Reactions
Moessbauer study of the kinetics of Fe^{3+} photoreduction on TiO_2 semiconductor powders, 11:11704 (J;US)
IRON HYDRIDES
Adsorption Isotherms
Irreversible effects in the FeTi-H system, 11:11567 (J;CH)
Catalytic Effects
Direct coal liquefaction using iron-titanium hydride as a hydrogen distribution and catalytic material. Progress report No. 5, September 1-November 30, 1985, 11:10786 (R;US)
Phase Studies
Irreversible effects in the FeTi-H system, 11:11567 (J;CH)
IRON OXIDES
Chemical Preparation
Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs, 11:11598 (J;US)
Electrical Properties
Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs, 11:11598 (J;US)
Photochemistry
Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs, 11:11598 (J;US)
IRON PHOSPHIDES
Precipitation
Precipitate formation in austenitic stainless steel welds, 11:11545 (J;US)
IRON-GAMMA
X-Ray Spectra
Spectroscopy of Ldagger-series transitions for x-ray laser photopumping, 11:11760 (J;US)
IRRADIATION CAPSULES
Fuel Pins
"CAMERA" test facility in the OSIRIS reactor. Diametral measurement device under flux of PWR fuel pins, 11:11275 (R;FR;In French)
ISOCYANATES
Photoelectron Spectroscopy
Transition metal-isocyanide bonding: Photoelectron spectroscopic study of iron tetracarbonyl isocyanide complexes, 11:11659 (J;US)
ISOMERIC NUCLEI
Hyperfine Structure
First results from the UNISOR collinear laser facility, 11:12067 (R;US)
Spectral Shift
First results from the UNISOR collinear laser facility, 11:12067 (R;US)
ISOTONES
See ISOTONIC NUCLEI
ISOTONIC NUCLEI
Nuclei having identical number of neutrons.
Nuclear Magnetic Moments
Study of magnetic moments of nuclear excited states at TRISTAN, 11:12283 (J;NL)
ISOTOPE ENRICHMENT
See ISOTOPE SEPARATION
ISOTOPE SEPARATION
For separation of isotopes of the same element only.
Cost
Process design criteria for a plant producing nitrogen-15, 11:11112 (R;US)
Ion Plasma Waves
Effect of collisions on the mechanism of isotope separation by ion-cyclotron waves, 11:12441 (R;BR)
Mathematical Models
Isotope separation in a rotational plasma, 11:12472 (TJ;AU)
ISOTOPIC SEPARATION
See ISOTOPE SEPARATION
ISRAEL
Coal Preparation Plants
CoaLiquid, Inc. coal slurry fuels commercial program - 1985, 11:10843 (RA;US)
Demonstration Programs
Demonstration and various test applications of COM in Israel (Coal oil mixtures), 11:10834 (RA;US)

J

JACOBIAN FUNCTION
Newton Method
Quasi-Newton methods with bounds, 11:12518 (R;US)
JAILS
See PUBLIC BUILDINGS
JAPAN
Coal Preparation Plants
Preparation test of HCWS at a pilot plant in 1984 (Highly-loaded coal water slurry), 11:10838 (RA;US)
Fossil-Fuel Power Plants
Panama coal to methanol project. Phase I. Feasibility Study. Technical progress report, 11:11140 (R;US)
Power Generation
Panama coal to methanol project. Phase I. Feasibility Study. Technical progress report, 11:11140 (R;US)
Research Programs
Slurry characteristics of various overseas coal bases on the pilot scale test, 11:10837 (RA;US)
JET ENGINE FUELS
Gas Chromatography
Aspects of high-resolution gas chromatography as applied to the analysis of hydrocarbon fuels and other complex organic mixtures. Volume 2. Survey of sample-insertion techniques. Final report, January-September 1980, 11:11603 (R;US)
JETS
Particle Identification
Flavour tagging of parton jets, 11:12144 (R;US)
JUICES
See BEVERAGES

K

K01
See KAONS NEUTRAL SHORT-LIVED
KAON BEAMS
Beams for kaon research, 11:11793 (R;US)
KAONS
See also KAONS MINUS
KAONS NEUTRAL
KAONS PLUS
Particle Production
Subthreshold kaon production as a probe of the nuclear equation of state, 11:12375 (J;US)
KAONS 1
See KAONS NEUTRAL SHORT-LIVED
KAONS MINUS
Particle Production
Search for quark deconfinement: Strangeness production in pp, dd, pα, and αα collisions at $\sqrt{s}$/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)
KAONS NEUTRAL
See also KAONS NEUTRAL SHORT-LIVED
Weak Hadronic Decay
[Review of experiments measuring CP nonconservation], 11:12154 (R;US)
KAONS NEUTRAL SHORT-LIVED
Photoproduction
Study of inclusive K/sub S/°, Λ, and Lambda-bar production in diffractive γp interactions, 11:12165 (J;US)

KAONS PLUS
Particle Production
Search for quark deconfinement: Strangeness production in pp, dd, pα, and αα collisions at √s/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)
Radiative Decay
Structure radiation in K → 2πγ decays, 11:12205 (R;SU;In Russian)
KENTUCKY
Coal Preparation Plants
CoaLiquid, Inc. coal slurry fuels commercial program - 1985, 11:10843 (RA;US)
KETONES
See also ACETOPHENONE
METHYL ISOBUTYL KETONE
Elutriation
Elution of benzene and methyl ethyl ketone from charcoal beds by continued air sweeping. Interim report, March 1983-November 1984, 11:11782 (R;US)
Reduction
Determination of radical initiating and hydrogen donating properties of coal liquefaction process solvents by reaction with fluorenone (Reduction of fluorenone to fluorene by coal liquefaction process solvents), 11:10792 (R;US)
KINK INSTABILITY
Mathematical Models
Stability of electron cyclotron waves in the presence of strong electron cyclotron heating, 11:12440 (R;US)
KNOCK-ON ELECTRONS
See ELECTRONS
KOPPERS-TOTZEK PROCESS
Comparative Evaluations
Surface gasification data system: feasibility studies overview report, 11:10778 (R;US)
KOREA (SOUTH)
See REPUBLIC OF KOREA
KORTEWEG-DE VRIES EQUATION
Symmetry Breaking
Spontaneous symmetry breaking and neutral stability in the noncanonical Hamiltonian formalism, 11:12434 (R;US)
KRYPTON
Adducts
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
Dimers
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
Photoionization
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
KRYPTON 84 REACTIONS
Heavy Ion Fusion Reactions
Fission-like phenomena for systems with mass A=110, 11:12312 (R;FR)
KRYPTON IONS
Electron-Ion Collisions
Indirect processes in electron impact ionization of multiply-charged ions, 11:12106 (J;NL)

L

LA REINA REACTOR
See RESEARCH REACTORS
LABORATORIES
Construction
Siting, constructing, and maintaining a deep underground science laboratory, 11:12175 (J;US)
Information
Refrigeration technology laboratories introduce themselves, 11:11382 (RA;DE;In German)
Maintenance
Siting, constructing, and maintaining a deep underground science laboratory, 11:12175 (J;US)
Site Selection
Siting, constructing, and maintaining a deep underground science laboratory, 11:12175 (J;US)
LABORATORY BUILDINGS
Solar Air Conditioning
Solar air conditioning, 11:11180 (RA;PR)
LAGRANGE FIELD EQUATIONS
See LAGRANGIAN FIELD THEORY
LAGRANGIAN
See LAGRANGIAN FUNCTION
LAGRANGIAN FIELD THEORY
Gauge Invariance
Two gauge fields in the same group, 11:12221 (R;BR)
Vacuum States
Decay rate of the false vacuum at high temperatures, 11:12236 (R;BR)
LAGRANGIAN FUNCTION
Quantization
Conventional Hamiltonian for first-order differential systems, 11:12413 (R;BR)
LAKES
See also GREAT LAKES
Limnology
Chlorophyll a concentration and distribution in Twin Lakes, Colorado prior to operation of Mt. Elbert Pumped-Storage Powerplant, 1977-1981. Technical report, 11:11154 (R;US)
Mineral Cycling
Predicting the effect of macro-benthos on the sediment/water flux of metals and phosphorus, 11:11912 (J;CA)
Water Pollution
Chlorophyll a concentration and distribution in Twin Lakes, Colorado prior to operation of Mt. Elbert Pumped-Storage Powerplant, 1977-1981. Technical report, 11:11154 (R;US)
LAMBDA 2282 RESONANCES
See LAMBDA C PLUS
LAMBDA C PLUS
Prior to Jan. 1985 this information was indexed with the descriptor Lambda-2250 Resonances.
Lifetime
Lambda+ sub(c) lifetime in a quark-diquark scheme, 11:12181 (R;BR)
LAMBDA NEUTRAL
See LAMBDA PARTICLES
LAMBDA PARTICLES
Photoproduction
Study of inclusive K/sub S/°, Λ, and Lambda-bar production in diffractive γp interactions, 11:12165 (J;US)
Three-Body Problem
Few-body strange systems, 11:12372 (R;US)
LAMBDA-2250 RESONANCES
See LAMBDA C PLUS
LAMBDA-2260 RESONANCES
See LAMBDA C PLUS
LAMINOGRAPHY
See TOMOGRAPHY
LAND FILLS
See SANITARY LANDFILLS
LAND RECLAMATION
Forestry
First observations of ecological surveillance plots on afforested open-cast spoil in South Wales. Occasional paper, 11:10810 (R;GB)
Terrestrial Ecosystems
First observations of ecological surveillance plots on afforested open-cast spoil in South Wales. Occasional paper, 11:10810 (R;GB)
LAND USE
Competition
Food crop versus energy-crop production in the Caribbean, 11:11138 (RA;PR)
LANDFILLS
See SANITARY LANDFILLS
LANTHANIDES
See RARE EARTHS
LANTHANUM ALLOYS
Moessbauer Effect
Mossbauer studies on LaNi(4.7)Sn(0.3) and its hydride, 11:11411 (R;US)

LANTHANUM CHROMITES
See LANTHANUM OXIDES

LANTHANUM COMPOUNDS
See also LANTHANUM OXIDES
Mass Spectroscopy
Mass spectrometry of inductively coupled plasmas, 11:11624 (J;US)

LANTHANUM OXIDES
Phase Studies
Analytical electron microscopy studies of precipitation in ceramic systems, 11:11558 (R;US)

LARGE COIL PROGRAM
Feasibility Studies
Superconducting magnet research and development program, 11:12483 (R;US)

LASER FUSION REACTORS
Breeding Blankets
Neutron activation in Cascade: the BeO/$LiAlO_2$ case, 11:12507 (R;US)
Research Programs
[Laser energetics quarterly report, January-March 1985]. Volume 22, 11:12430 (R;US)

LASER IMPLOSIONS
Absorption Spectroscopy
[Experiments on the OMEGA Laser System]. LLE Review. Quarterly report, July-September 1985. Volume 24, 11:12489 (R;US)
Computerized Simulation
[Experiments on the OMEGA Laser System]. LLE Review. Quarterly report, July-September 1985. Volume 24, 11:12489 (R;US)
Model for optical-laser-induced impulse in vacuo, 11:12496 (R;US)
Simulation of experiments in spherical irradiation at $\lambda = 351$ nm (351 nm), 11:12485 (R;US)
Hydrodynamics
[Experiments on the OMEGA Laser System]. LLE Review. Quarterly report, July-September 1985. Volume 24, 11:12489 (R;US)
Thermodynamic Model
[Laser energetics quarterly report, January-March 1985]. Volume 22, 11:12430 (R;US)

LASER RADIATION
Coherent Scattering
Raman scattering in experiments with planar Au targets irradiated with 0.53 μm laser light, 11:11532 (J;US)
Nonlinear Problems
Quantum theory of a one-dimensional laser with output coupling. 2. Nonlinear theory, 11:12410 (R;BR)
Quantum Mechanics
Laser theory in the absence of adiabatic hypothesis: linear approximation, 11:12411 (R;BR)
Quantum theory of a one-dimensional laser with output coupling. 2. Nonlinear theory, 11:12410 (R;BR)

LASER TARGETS
Ablation
LLE Review. Quarterly report, April-June 1985, 11:12488 (R;US)
Thermal transport: a comparison between solid and shell targets, 11:12490 (R;US)
Computer-Aided Design
Laser Program annual report 1984, 11:12505 (R;US)
Computerized Simulation
Thermal transport: a comparison between solid and shell targets, 11:12490 (R;US)
Deposition
[Glass Development Laser (GDL) Facility upgrade.] LLE Review. Quarterly report, October-December 1984. Volume 21, 11:12487 (R;US)
Fabrication
Laser Program annual report 1984, 11:12505 (R;US)
Laser Implosions
Simulation of experiments in spherical irradiation at $\lambda = 351$ nm (351 nm), 11:12485 (R;US)
X-Ray Spectroscopy
Thermal transport: a comparison between solid and shell targets, 11:12490 (R;US)

LASER-PRODUCED PLASMA
Electron Plasma Waves
Electron heating caused by parametrically driven turbulence near the critical density, 11:12509 (J;US)
Electron Temperature
Electron heating caused by parametrically driven turbulence near the critical density, 11:12509 (J;US)
Energy Losses
Measurements of energetic electron distributions in uv and ir laser plasmas, 11:12486 (R;US)
Hot Plasma
Electron heating caused by parametrically driven turbulence near the critical density, 11:12509 (J;US)
Images
Soft X-ray imaging with axisymmetry microscope and electronic readout, 11:12426 (R;FR)
Ion Waves
Electron heating caused by parametrically driven turbulence near the critical density, 11:12509 (J;US)
Laser Implosions
Works on laser-matter interaction program at the Limeil-Valenton center, 11:12427 (R;FR;In French)
Nonlinear Problems
Electron heating caused by parametrically driven turbulence near the critical density, 11:12509 (J;US)
Plasma Instability
Measurements of energetic electron distributions in uv and ir laser plasmas, 11:12486 (R;US)
Raman Effect
Raman scattering in experiments with planar Au targets irradiated with 0.53 μm laser light, 11:11532 (J;US)
Research Programs
Laser Program annual report 1984, 11:12505 (R;US)
Resonance Absorption
Measurements of energetic electron distributions in uv and ir laser plasmas, 11:12486 (R;US)
Turbulence
Electron heating caused by parametrically driven turbulence near the critical density, 11:12509 (J;US)
X-Ray Spectra
Measurements of energetic electron distributions in uv and ir laser plasmas, 11:12486 (R;US)

LASERS
Light Amplification by Stimulated Emission of Radiation.
See also FREE ELECTRON LASERS
SOLID STATE LASERS
X-RAY LASERS
Synchronization
LLE Review. Quarterly report, April-June 1985, 11:12488 (R;US)

LATEX
Biological Accumulation
Retention of ingested latex particles in Peyer's patches of germ-free and conventional mice, 11:12010 (J;US)
Retention
Retention of ingested latex particles in Peyer's patches of germ-free and conventional mice, 11:12010 (J;US)
Tissue Distribution
Retention of ingested latex particles in Peyer's patches of germ-free and conventional mice, 11:12010 (J;US)

LATTICE FIELD THEORY
Mass Spectra
Quarkonia spectra from lattice gauge theories, 11:12266 (J;NL)
Mesons
Lattice results on the meson electric form factor, 11:12254 (R;CA)
Sound Waves
Velocity of sound in SU(3) lattice gauge theory, 11:12262 (J;US)

LEACHATES
Chemical Analysis
Mobility of organic and inorganic constituents from energy and combustion-related wastes under codisposal conditions, 11:11484 (J;US)

Chemical Composition
Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas, 11:10802 (RA;US)

LEAD
Capacitance
Effect of microscopic structure of metal electrode on capacitance of metal - molten salt interface, 11:11519 (R;IT)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
Ion-Atom Collisions
L-shell X-ray production cross sections in Nd, Gd, Ho, Yb, Au and Pb for 25-MeV carbon and 32-MeV oxygen ions, 11:12110 (J;NL)
Physical Radiation Effects
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
Pollution Sources
Lead as an environmental pollutant, 11:11895 (RA;XE)
Proton Reactions
Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)

LEAD 208 TARGET
Alpha Reactions
Statistical decay of giant monopole resonance in ^{208}Pb, 11:12343 (R;BR)
Antiproton Reactions
Antiproton-nucleon physics at LEAR, 11:12284 (R;FR;In French)
Electron Reactions
Possibility of excitation twist mode selection in the (e, e') reaction, 11:12330 (R;SU;In Russian)
Neutron Reactions
Low-energy optical-model analysis of ^{208}Pb and ^{209}Bi, 11:12345 (J;NL)
Photonuclear Reactions
Measurement of cross sections of total nuclear photon absorption by the ^{12}C and ^{208}Pb nuclei in the Δ(1232) region, 11:12294 (R;FR;In French)
Proton Reactions
Reactive content of the proton-nucleus impulse - approximation Dirac optical potential, 11:12319 (R;BR)

LEAD 210
Radiochemical Analysis
Techniques of sample attack used in soil and mineral analysis. Phase I, 11:11614 (R;CA)

LEAD ALLOYS
Electric Conductivity
Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem, 11:11518 (R;IT)

LEAD OXIDES
Catalytic Effects
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)

LEAD-ACID BATTERIES
Materials
Testing and development of electric vehicle batteries for EPRI Electric Transportation Program. Technical report for November 1982-December 1984, 11:11362 (R;US)

LEASES
Environmental Impact Statements
Final environmental impact statement: proposed central Gulf of Mexico OCS Lease Sale 104 (April 1986) and proposed western Gulf of Mexico OCS Lease Sale 105 (July 1986), 11:10964 (R;US)
Final environmental impact statement: proposed Norton Basin Lease Sale 100. Volume 1, 11:10938 (R;US)

LECTINS
Biochemistry
Membrane-bound β-lectins: agglutination of protoplasts by multivalent phenyl-β-glucosides, 11:11943 (RA;US)

LED
See LIGHT EMITTING DIODES

LENNARD-JONES POTENTIAL
Kernels
Collision kernels in the eikonal approximation for Lennard-Jones interaction potential, 11:12084 (R;IT)

LEP STORAGE RINGS
European Large Electron-Positron storage rings.
Polarized Beams
Survey of fully antisymmetric rotators for the electron rings HERA and LEP, 11:11810 (R;FR)
Shower Counters
OPAL experiment at LEP: P. Rapp progress report, 11:11807 (RA;US)

LEPTON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

LEPTONS
See also ELECTRONS
MUONS
NEUTRINOS
Gauge Invariance
Possible interaction between spin-1/2 and spin-3/2 fields, 11:12179 (R;BR)
Lagrangian Field Theory
Possible interaction between spin-1/2 and spin-3/2 fields, 11:12179 (R;BR)
Leptonic Decay
New weak boson decays and possible spin 3/2 leptons, 11:12186 (R;BR)
Pair Production
Same-sign dilepton production by neutrinos, 11:12141 (R;US)

LEWIS BASES
Ion Exchange Chromatography
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 11:11635 (D;US)

LIE GROUPS
See also GRADED LIE GROUPS
Mathematical Operators
Multiplet classification of the indecomposable highest weight modules over affine Lie algebras and invariant differential operators: the asub(l)sup((1)) example, 11:12227 (R;IT)
Multiplets
Multiplet classification of the indecomposable highest weight modules over affine Lie algebras and invariant differential operators: the asub(l)sup((1)) example, 11:12227 (R;IT)
Multiplets of indecomposable highest weight modules over infinite-dimensional Lie algebras: The Virasoro - A_1 correspondence, 11:12228 (R;IT)

LIE SUPERALGEBRA
See GRADED LIE GROUPS

LIGASES
Code number 6.
Biochemistry
Regulatory mechanisms for the synthesis of β-glucans in plants, 11:11927 (RA;US)

LIGHT EMITTING DIODES
Physical Radiation Effects
30-MeV electron-beam irradiation effects on GaAs(1-x)P(x) LEDS (light emitting diodes). Master's thesis, 11:11572 (R;US)

LIGHT WATER COOLED REACTORS
See WATER COOLED REACTORS

LIGHT WATER MODERATED REACTORS
See WATER MODERATED REACTORS

LIGHTING SYSTEMS
Energy Efficiency
Energy and lighting, 11:11453 (J;US)
Energy sources: conservation and renewables, 11:11450 (B;US)
Research Programs
Energy and lighting, 11:11453 (J;US)

LIGNITE
Biodegradation
Biodegradation and bioconversion of coals by fungi. Quarterly progress report No. 1, October 1-December 31, 1985, 11:10787 (R;US)
Microbial screening test for lignite degradation. Quarterly progress report No. 4, October-December 1985, 11:10799 (R;US)

Drying
Production and combustion of hot-water-dried lignite slurries, 11:10827 (RA;US)
Electrolysis
Products found in the anodic oxidation of coal, 11:11122 (J;GB)
Fluidized-Bed Combustion
Technical and economic aspects of a lignite-fired AFBC boiler, 11:10901 (RA;US)
Heavy Media Separation
Chlorinated solvents for coal beneficiating, 11:10829 (RA;US)
Oxidation
Microbial screening test for lignite degradation. Quarterly progress report No. 4, October-December 1985, 11:10799 (R;US)
Research Programs
Preparation, handling, and storage, 11:10851 (RA;US)
Weathering
Biodegradation and bioconversion of coals by fungi. Quarterly progress report No. 1, October 1-December 31, 1985, 11:10787 (R;US)

LIMBS
Radiosensitivity
Extremity monitoring: considerations for use, dosimeter placement, and evaluation, 11:11998 (R;US)
Spatial Dose Distributions
Extremity monitoring: considerations for use, dosimeter placement, and evaluation, 11:11998 (R;US)

LIMITERS
Crack Propagation
Review of failure criteria for thin wall structures in a high heat flux environment, 11:12508 (R;US)

LINACS
See LINEAR ACCELERATORS

LINEAR ACCELERATORS
Colliding Beams
Report of the HEPAP Subpanel on Advanced Accelerator R and D and the SSC, 11:11784 (R;US)
Design
Inductively insulated Marx generator, 11:11806 (J;US)
Marx Generators
Inductively insulated Marx generator, 11:11806 (J;US)
Technology Assessment
Report of the HEPAP Subpanel on Advanced Accelerator R and D and the SSC, 11:11784 (R;US)

LINKING (BOREHOLE)
See BOREHOLE LINKING

LIPIDS
Production
Studies of marine macroalgae: saline desert water cultivation and effects of environmental stress on proximate composition. Final subcontract report (Gracilaria tikvahiae; Ulva lactuca), 11:11170 (R;US)

LIPPMANN-SCHWINGER EQUATION
Distorted Wave Theory
Method for solving the Lippmann-Schwinger equation. I. Single channel case, 11:12081 (R;AU)

LIQUEFIED NATURAL GAS
Infrared Radiation
Vapor spill monitoring method, 11:10966 (P;US)
Quantitative Chemical Analysis
Vapor spill monitoring method, 11:10966 (P;US)
Sampling
Vapor spill monitoring method, 11:10966 (P;US)

LIQUEFIED PETROLEUM GASES
Domestic Supplies
Firewood versus alternatives: domestic fuel in Mexico. Occasional paper, 11:11150 (R;GB)

LIQUEFIERS
See CONDENSERS

LIQUID CRYSTALS
Phase Transformations
Transitions in a lyomesophase: a study by thermal analysis and electron microscopy, 11:11581 (R;BR)

LIQUID EFFLUENTS
See LIQUID WASTES

LIQUID IONIZATION CHAMBERS
Physical Radiation Effects
Estimation of the measurement effective point in cylindrical ionization chamber used in electron beams with energies between 6 and 20 MeV, 11:11846 (R;BR;In Portuguese)

LIQUID METAL COOLANT
See LIQUID METALS

LIQUID METALS
Electric Conductivity
Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem, 11:11518 (R;IT)
Energy-Level Density
Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem, 11:11518 (R;IT)
Heat Transfer
Magnetohydrodynamic natural convection heat transfer from horizontal cylinders, 11:11551 (J;GB)
Magnetohydrodynamics
Magnetohydrodynamic natural convection heat transfer from horizontal cylinders, 11:11551 (J;GB)
Natural Convection
Magnetohydrodynamic natural convection heat transfer from horizontal cylinders, 11:11551 (J;GB)

LIQUID METAL-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS

LIQUID PHASE METHANOL PROCESS
Catalysts
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Process Development Units
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)

LIQUID WASTES
See also SPENT LIQUORS
WASTE WATER
Radiolysis
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)

LIQUIDS
See also COAL LIQUIDS
LIQUID CRYSTALS
LIQUID METALS
Refractivity
Transmission measurements of selected liquids in the far infrared, 11:12445 (R;US)

LITHIUM
Boiling Points
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Critical Pressure
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Critical Temperature
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Desorption
Silicon (111) and (100) surfaces and their interactions with Sc, K, Na and Li; phase changes and kinetics of desorption studied by surface ionization, 11:11667 (J;NL)
Melting Points
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Metallurgical Effects
Lithium insertion in $V_3Nb_9O_{29}$. A Wadsley-Roth type phase. Technical report, June 1984-July 1985, 11:11361 (R;US)
Purification
Lithium purification technique, 11:12510 (P;US)
Toxicity
In vivo measurement of lithium in the body by a neutron activation analysis technique, 11:11980 (J;US)

LITHIUM 10
Nuclear Radii
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
LITHIUM 11
Nuclear Radii
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
LITHIUM 6
Pion Plus Reactions
Angular dependence of the sup(6)Li(πsup(+), sup(3)He)sup(3)He reaction, 11:12304 (R;CA)
LITHIUM 6 REACTIONS
Cross Sections
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
LITHIUM 7 REACTIONS
Cross Sections
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
LITHIUM 8 REACTIONS
Cross Sections
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
LITHIUM 9
Nuclear Radii
Measurements of interaction cross sections and nuclear radii in the light p-shell region, 11:12307 (J;US)
LITHIUM ALLOYS
Electric Conductivity
Calculations of the electronic density of states and conductivity consistent with the generalized optical theorem, 11:11518 (R;IT)
Ionic Conductivity
Transport mechanisms in β-lithium/aluminum: an overview, 11:11367 (R;US)
Mass Transfer
Transport mechanisms in β-lithium/aluminum: an overview, 11:11367 (R;US)
Plasticity
Superplastic properties of an Al-Cu-Li-Zr alloy, 11:11542 (J;GB)
LITHIUM COMPOUNDS
See also LITHIUM HYDRIDES
LITHIUM OXIDES
Physical Radiation Effects
Irradiation of lithium aluminate and tritium extraction, 11:12474 (R;FR)
LITHIUM FLUORIDES
Electron Channeling
Channeling-radiation measurements at Lawrence Livermore National Laboratory, 11:11597 (J;NL)
Positron Channeling
Channeling-radiation measurements at Lawrence Livermore National Laboratory, 11:11597 (J;NL)
LITHIUM HYDRIDES
Electron Channeling
Channeling-radiation measurements at Lawrence Livermore National Laboratory, 11:11597 (J;NL)
Positron Channeling
Channeling-radiation measurements at Lawrence Livermore National Laboratory, 11:11597 (J;NL)
LITHIUM IONS
Emission
Negative-lithium emission from a tungsten surface in a plasma, 11:12119 (J;US)
LITHIUM OXIDES
X-Ray Spectra
Ion-excited K X-ray spectra of oxygen, 11:12076 (RA;US)
LMFBR TYPE REACTORS
See also EBR-2 REACTOR
Cost
Breeder reactor economics, 11:11265 (R;US)
Economics
Breeder reactor economics, 11:11265 (R;US)
Fuel Pins
Advanced-fuel performance model Euges-Aries. Description and listing of the computer program and introduction to its use, 11:11258 (R;DE)
Nuclear Materials Management
Key points on proliferation and the LMFBR, 11:11260 (R;US)
Proliferation
Key points on proliferation and the LMFBR, 11:11260 (R;US)
Reactor Protection Systems
Fast reactor status review. Development work on core protective instrumentation, 11:11358 (TJ;GB)
Reactor Safety
Reactor safety research semiannual report, January-June 1985. Volume 33, 11:11333 (R;US)
Spent Fuels
French experience and prospects in the reprocessing of fast breeder reactor fuels, 11:10985 (R;FR;In French)
Steam Generators
Heat flux limiting sleeves, 11:11259 (P;US)
LNG
See LIQUEFIED NATURAL GAS
LOAD ANALYSIS
Forecasting
Forecasting in an era of technological change: proceedings of fifth forecasting symposium, 11:11399 (R;US)
Meetings
Forecasting in an era of technological change: proceedings of fifth forecasting symposium, 11:11399 (R;US)
LOAD CHARACTERISTICS
See LOAD ANALYSIS
LOAD MANAGEMENT
Electric Batteries
Analysis of a customer-side-of-the-meter storage battery facility, 11:11218 (R;US)
LOBBIES
See INTEREST GROUPS
LOCA
See LOSS OF COOLANT
LOCAL GROUP
See GALAXIES
LOCK-IN AMPLIFIERS
Performance
Precision limits of lock-in amplifiers below unity signal-to-noise ratios, 11:11775 (J;US)
LOCKS (SECURITY)
See PHYSICAL PROTECTION DEVICES
LOFT REACTOR
Remote Viewing Equipment
Stress analysis of the LOFT inspection fixture periscope and camera storage stand, 11:11240 (R;US)
LONG WAVE RADIATION
Radiation Effects
Biological effects of electric fields, 11:12024 (R;US)
LONG-RANGE TRANSPORT
Mathematical Models
Design and analysis of Cross-Appalachian Tracer Experiment (CAPTEX) field trials. Second annual progress report (CAPTEX), 11:11857 (R;US)
LONGWALL MINING
Air Pollution
Factors affecting respirable dust generation from longwall roof supports. Information circular/1985, 11:10924 (R;US)
Safety Engineering
Remedial and stratareplacement techniques on longwall faces. Report on the state of the art. Information Circular/1985, 11:10823 (R;US)
Supports
Demonstration of shield-type longwall supports at Kaiser Steel Corporation's No. 1 mine, Utah. Open File report February 1980-April 1982, 11:10926 (R;US)
Factors affecting respirable dust generation from longwall roof supports. Information circular/1985, 11:10924 (R;US)
LOOPS (COOLANT)
See COOLANT LOOPS

LOOSE PARTS MONITORING
Summary of studies on methods for detecting, locating, and characterizing metallic loose parts in nuclear reactor coolant systems, 11:11229 (R;US)
LOSS OF COOLANT
After-Heat Removal
Modeling of reflux condensation and countercurrent annular flow in a two-phase closed thermosyphon, 11:11312 (R;US)
Chemical Reactions
Analysis of hydrogen production during a BWR6 core heatup transient, 11:11296 (R;US)
Computer Codes
TRAC-PF1/MOD1 independent assessment: LOBI large break transient A1-04R, 11:11330 (R;US)
Heat Transfer
Analysis of hydrogen production during a BWR6 core heatup transient, 11:11296 (R;US)
Overview of TRAC-BD1/MOD1 assessment studies, 11:11337 (R;US)
Pretest analysis document for Test S-NH-1, 11:11310 (R;US)
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
TRAC-P1A independent assessment, 1979, 11:11326 (R;US)
TRAC-PF1/MOD 1 independent assessment: Semiscale MOD-2A feedwater-line break (S-SF-3) and steam-line break (S-SF-5) tests, 11:11331 (R;US)
Hydraulics
Analysis of hydrogen production during a BWR6 core heatup transient, 11:11296 (R;US)
Overview of TRAC-BD1/MOD1 assessment studies, 11:11337 (R;US)
Pretest analysis document for Test S-NH-1, 11:11310 (R;US)
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
TRAC-P1A independent assessment, 1979, 11:11326 (R;US)
TRAC-PF1/MOD 1 independent assessment: Semiscale MOD-2A feedwater-line break (S-SF-3) and steam-line break (S-SF-5) tests, 11:11331 (R;US)
Mockup
Pretest analysis document for Test S-NH-1, 11:11310 (R;US)
LOSS OF FLOW
After-Heat Removal
EBR-II Shutdown Heat Removal Testing Program results and plans, 11:11299 (R;US)
LOSS OF FLUID TEST REACTOR
See LOFT REACTOR
LOUISIANA
Radioactive Waste Disposal
Managing the nation's nuclear waste. Site descriptions: Cypress Creek, Davis Canyon, Deaf Smith, Hanford Reference, Lavender Canyon, Richton Dome, Swisher, Vacherie Dome, and Yucca Mountain, 11:11007 (R;US)
LOW FREQUENCY RADIATION
See LONG WAVE RADIATION
LOW INCOME GROUPS
Federal Assistance Programs
Financial and Compliance Report on Federally Assisted Programs for the year ended June 30, 1984, 11:11376 (R;US)
LOW-HEAD HYDROELECTRIC POWER PLANTS
Prior to August 1978 HYDROELECTRIC POWER PLANTS was used.
Garland Canal Shoshone Irrigation District hydroelectric project: final operations and maintenance report. Small-Scale Hydroelectric Power Demonstration Project, 11:11152 (R;US)
Construction
"Rancho Hydro": a low-head, high volume residential hydroelectric power system, Anahola, Kauai, Hawaii, 11:11151 (R;US)
LOW-LEVEL RADIOACTIVE WASTES
Combustion
Technical evaluation of the topical report on the Koch Process Systems Low-Level Radwaste Volume Reduction System, 11:11015 (R;US)
Evaporation
Technical evaluation of the G.E. Transportable Modular AZTECH Plant topical report, 11:11014 (R;US)
Forecasting
Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1, 11:11005 (R;US)
Information Systems
Low level waste data base development - EPICOR-II resin/liner investigation. Program review, 11:11013 (R;US)
Inventories
Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1, 11:11005 (R;US)
Laws
Radioactive waste management: a summary of state laws and administration. National Low-Level Radioactive Waste Management Program. Revision 6, 11:11001 (R;US)
Legislation
Radioactive waste management: a summary of state laws and administration. National Low-Level Radioactive Waste Management Program. Revision 6, 11:11001 (R;US)
Radioactive Waste Disposal
Low level waste data base development - EPICOR-II resin/liner investigation. Program review, 11:11013 (R;US)
Radioactive waste management: a summary of state laws and administration. National Low-Level Radioactive Waste Management Program. Revision 6, 11:11001 (R;US)
Radioactive Waste Facilities
Technical evaluation of the G.E. Transportable Modular AZTECH Plant topical report, 11:11014 (R;US)
Radioactive Waste Processing
Low level waste data base development - EPICOR-II resin/liner investigation. Program review, 11:11013 (R;US)
Technical evaluation of the G.E. Transportable Modular AZTECH Plant topical report, 11:11014 (R;US)
Technical evaluation of the topical report on the Koch Process Systems Low-Level Radwaste Volume Reduction System, 11:11015 (R;US)
Radioactive Waste Storage
Characterization plan for Solid Waste Storage Area 6, 11:11027 (R;US)
Solidification
Technical evaluation of the G.E. Transportable Modular AZTECH Plant topical report, 11:11014 (R;US)
Underground Disposal
Analysis of alternatives for greater-confinement disposal of low-level radioactive waste, 11:11002 (R;US)
Investigation of siting parameters for near surface disposal of low-level nuclear waste. Final report, 11:11000 (R;US)
LP-GAS
See LIQUEFIED PETROLEUM GASES
LT-4 TOKAMAK
Data Acquisition Systems
Network approach to large-scale experimental data acquisition and analysis, 11:12473 (R;AU)
LUMBER INDUSTRY
See WOOD PRODUCTS INDUSTRY
LUNGS
Edema
New Compton densitometer for measuring pulmonary edema, 11:11979 (R;US)
Fibroblasts
Radiometric methods for rapid diagnosis of viral infection. Annual report, 1 February 1976-31 January 1977, 11:11984 (R;US)
Personnel Dosimetry
Stochastic lung dose modelling. A joint Austrian-Hungarian project, 11:11993 (RA;AT)
LURGI PROCESS
Comparative Evaluations
Surface gasification data system: feasibility studies overview report, 11:10778 (R;US)
LUTETIUM
Resonance Ionization Mass Spectroscopy
Effect of very weak laser sidebands on optical spectra involving easily saturable intermediate states, 11:11634 (J;US)

LUTETIUM 173
Shell Models
Fragmentation of subshells in rare earth nuclei, 11:12337 (R;SU;In Russian)
Strength Functions
Fragmentation of subshells in rare earth nuclei, 11:12337 (R;SU;In Russian)
LWR TYPE REACTORS
See WATER COOLED REACTORS
LYMPHOCYTES
Chromosomal Aberrations
Comparative studies of the dose-response relationship of radiation-induced chromosomal aberrations in human lymphocytes induced by low radiation doses, using Feulgen orcein glacial acetic acid and FPG staining, 11:11996 (R;DE;In German)
LYMPHOID CELLS
See LYMPHOCYTES

M

MA 956
See IRON BASE ALLOYS
MACERALS
Fluorescence
Laser induced coal fluorescence. Twelfth quarterly technical progress report, July 1-September 31, 1985, 11:10798 (R;US)
MACHINE PARTS
Fabrication
Method for producing hard-surfaced tools and machine components, 11:11541 (P;US)
MAGNESIUM
Chemical Preparation
Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs, 11:11598 (J;US)
Electrical Properties
Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs, 11:11598 (J;US)
Photochemistry
Preparation, electrical and photoelectrochemical properties of magnesium doped iron oxide sintered discs, 11:11598 (J;US)
MAGNESIUM 24
High Spin States
^{24}Mg yrast sequence up to 30 MeV excitation, 11:12314 (R;BR)
Yrast States
^{24}Mg yrast sequence up to 30 MeV excitation, 11:12314 (K;BR)
MAGNESIUM 24 TARGET
Heavy Ion Fusion Reactions
Fission-like phenomena for systems with mass A=110, 11:12312 (R;FR)
MAGNESIUM 26
Energy Levels
Use of energy-averaged cross sections for nuclear spectroscopy: ^{26}Mg states in the continuum, 11:12313 (R;BR)
MAGNESIUM CHLORIDES
Interference
Suppression of analyte signal by various concomitant salts in inductively coupled plasma mass spectrometry, 11:11625 (J;US)
MAGNESIUM IONS
Collisions
Projectile velocity dependence of the alignment of He-like 2P-states of foil excited S projectiles, 11:12070 (RA;US)
Electron-Ion Collisions
Electron collisions with positive ions. Progress report, April 1, 1985-March 31, 1986, 11:12079 (R;US)
P States
Projectile velocity dependence of the alignment of He-like 2P-states of foil excited S projectiles, 11:12070 (RA;US)
MAGNESIUM OXIDES
Catalytic Effects
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)
Grain Boundaries
Influence of anisotropy and doping on grain boundary diffusion in oxide systems, 11:11566 (J;NL)
Phase Studies
Analytical electron microscopy studies of precipitation in ceramic systems, 11:11558 (R;US)
X-Ray Spectra
Ion-excited K X-ray spectra of oxygen, 11:12076 (RA;US)
MAGNET COILS
Bolted Joints
Mechanical testing and development of the helical field coil joint for the Advanced Toroidal Facility, 11:12481 (R;US)
Installation
K500 cyclotron magnet, 11:11795 (RA;US)
Power Supplies
Trim coil power supplies, 11:11798 (RA;US)
MAGNETIC COILS
See MAGNET COILS
MAGNETIC DIPOLES
Design
Possible uses of the DLS dipoles in a search for the quark-gluon plasma at the AGS, 11:11814 (R;US)
MAGNETIC FIELDS
See also GEOMAGNETIC FIELD
Turbulence
Dynamics and fluctuation spectra of electrostatic resistive interchange turbulence, 11:12437 (R;US)
MAGNETOHYDRODYNAMIC GENERATORS
See MHD GENERATORS
MAGNETOHYDRODYNAMICS
Three-Dimensional Calculations
Existence and calculation of sharp boundary MHD equilibrium in three-dimensional toroidal geometry, 11:12436 (R;US)
MAGNETOSPHERE
See EARTH MAGNETOSPHERE
MAGNETS
Test Facilities
Major facilities for materials research and related disciplines. Final report, 11:11118 (R;US)
MAHOGANY TREES
See TREES
MAINTENANCE FACILITIES
Engineering
Design considerations for coal-water slurry handling systems at utility and industrial plants, 11:10835 (RA;US)
MALIGNANCIES
See NEOPLASMS
MAN
All of mankind, of any age or of either sex.
Biological Radiation Effects
Sterilization of human bone by irradiation. Final report, 11:11991 (R;US)
Radiation Injuries
Analysis of various aspects of atomic bomb dose estimation at RERF using data on acute radiation symptoms, 11:12005 (J;US)
MANGANESE 55 TARGET
Neutron Reactions
Resonance neutron capture by manganese below 2.5 keV, 11:12322 (J;US)
MANGANESE ALLOYS
Creep
Creep-rupture behavior of iron superalloys in high-pressure hydrogen, 11:11516 (R;US)
Production
Formation of surface layers of icosahedral Al(Mn), 11:11528 (R;US)
MANGANESE IONS
Physical Radiation Effects
Study of the thermal annealing of γ-irradiation effects in Al_2O_3: Mn, 11:11554 (R;FR)

X-Ray Spectra
Spectroscopy of Ldagger-series transitions for x-ray laser photopumping, 11:11760 (J;US)
MANUFACTURED BUILDINGS
See PREFABRICATED BUILDINGS
MANUFACTURING FACILITIES
See INDUSTRIAL PLANTS
MANURES
Anaerobic Digestion
Use of appropriate technologies for biomass waste conversion in small communities, 11:11126 (RA;PR)
MANY-BODY PROBLEM
See also TWO-BODY PROBLEM
Bound State
Bound-states of N particles: a variational approach, 11:12407 (R;BR)
Quantization
Homotopy and statistics in quantum theory, 11:12404 (R;BR)
Variational Methods
Bound-states of N particles: a variational approach, 11:12407 (R;BR)
MARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
MARX GENERATORS
Design
Inductively insulated Marx generator, 11:11806 (J;US)
Fabrication
Inductively insulated Marx generator, 11:11806 (J;US)
MARYLAND
Fossil-Fuel Power Plants
Upper bay network: a study of the plankton resources of the upper Chesapeake Bay. Volume 1, text. Volume 2, Appendices a-o. Final report 1982-1983, 11:11909 (R;US)
MASS SPECTROSCOPY
Standards
Evaluation of uranium and plutonium internal standards, 11:11619 (R;US)
MASS (THERMAL)
See THERMAL MASS
MASSACHUSETTS INSTITUTE OF TECHNOLOGY ALC
See ALCATOR DEVICE
MASURIUM
See TECHNETIUM
MATERIALS
See also BUILDING MATERIALS
COMPOSITE MATERIALS
DOPED MATERIALS
FERTILE MATERIALS
GRANULAR MATERIALS
POROUS MATERIALS
RADIOACTIVE MATERIALS
REACTOR MATERIALS
SEMICONDUCTOR MATERIALS
THERMONUCLEAR REACTOR MATERIALS
TOXIC MATERIALS
Diffusion
Monte Carlo calculation of correlation and vacancy wind effects in diffusion, 11:11550 (J;CH)
Physical Radiation Effects
Cascade-induced fluctuations and the transition from the stable to the critical cavity radius for swelling, 11:11510 (R;US)
MATERIALS (BUILDING)
See BUILDING MATERIALS
MATERIALS (COMPOSITE)
See COMPOSITE MATERIALS
MATERIALS (DOPED)
See DOPED MATERIALS
MATERIALS (FERROMAGNETIC)
See FERROMAGNETIC MATERIALS
MATERIALS HANDLING EQUIPMENT
Engineering
Design considerations for coal-water slurry handling systems at utility and industrial plants, 11:10835 (RA;US)
MATERIALS (POROUS)
See POROUS MATERIALS
MATERIALS (SEMICONDUCTOR)
See SEMICONDUCTOR MATERIALS
MATERIALS WORKING
Covers metal and non-metal working.
Crystal plasticity analysis of large-strain shear, 11:11529 (R;US)
MATHEMATICAL MODELS
See also CLIMATE MODELS
COSMOLOGICAL MODELS
Comparative Evaluations
Comparison of predictions from internationally recognized assessment models for the transfer of selected radionuclides through terrestrial food chains, 11:11904 (J;US)
MATTER
See also NUCLEAR MATTER
QUARK MATTER
Electronic Structure
Matter under extreme conditions of temperature and pressure, 11:11661 (J;GB)
Excitation
Matter under extreme conditions of temperature and pressure, 11:11661 (J;GB)
MCPP
See DUAL-PURPOSE POWER PLANTS
MEAT
Mutagen Screening
Mutagen formation in a model beef boiling system. III. Purification and identification of three heterocyclic amine mutagens-carcinogens, 11:12011 (J;US)
Quality Assurance
Influence of the cooling process on the sensory characteristics of fresh meat, 11:11468 (RA;DE;In German)
Refrigeration
Influence of the cooling process on the sensory characteristics of fresh meat, 11:11468 (RA;DE;In German)
MECHANICAL EFFECTS
See MECHANICAL PROPERTIES
MECHANICAL PROPERTIES
Mathematical Models
Overview of hygrothermomechanical response modeling associated with underground coal conversion, 11:10773 (RA;US)
Simulation
Overview of hygrothermomechanical response modeling associated with underground coal conversion, 11:10773 (RA;US)
MECHANICAL STRUCTURES
See also SUPPORTS
Mechanical Vibrations
Rectangular plate is proposed as an IES modal test structure, 11:11748 (R;US)
MECHANICAL VIBRATIONS
Monitoring
Utility machinery vibration monitoring guide (Interim), 11:11226 (R;US)
Numerical Solution
Exact integration algorithm for use with modal analysis, 11:11743 (R;US)
MEETINGS
Hydrogen behaviour and control and related containment loading aspects. Proceedings of a specialists' meeting organized by the IAEA and held in Suzdal, USSR, 19-23 September 1983, 11:11644 (R;AT)
MELTDOWN
Evaluation of the bases for estimating alpha-mode failure probabilities, 11:11350 (R;US)
Aerosols
Effects of reactor core-simulant aerosols on hydrogen/air combustion, 11:11349 (R;US)
Fission Product Release
Mechanistic determination of fission product releases for a Mark III BWR plant, 11:11297 (R;US)
Fluid-Structure Interactions
Liquid jet breakup characterization with application to melt-water mixing, 11:11295 (R;US)
Heat Transfer
MELRPI - development and use, 11:11301 (R;US)
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)

Hydraulics
Estimates of early containment loads from core melt accidents. Draft report for comment, 11:11325 (R;US)
MELRPI - development and use, 11:11301 (R;US)
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
Molten Metal-Water Reactions
Liquid jet breakup characterization with application to melt-water mixing, 11:11295 (R;US)
Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels, 11:11348 (R;US)
Two-dimensional empirical model for analyzing steam explosion experiments, 11:11344 (R;US)
Risk Assessment
Core material redistribution accompanying accident sequences leading to degraded cores, 11:11346 (R;US)
Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels, 11:11348 (R;US)
Two-dimensional empirical model for analyzing steam explosion experiments, 11:11344 (R;US)
Thermal Stresses
Estimates of early containment loads from core melt accidents. Draft report for comment, 11:11325 (R;US)
Thermodynamics
Estimates of early containment loads from core melt accidents. Draft report for comment, 11:11325 (R;US)

MELTING
Electron Diffraction
[Experiments on the OMEGA Laser System]. LLE Review. Quarterly report, July-September 1985. Volume 24, 11:12489 (R;US)

MERCURY
Absorption Spectroscopy
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)
Adducts
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
Biological Effects
Physicochemical rationale for the biological activity of mercury and its compounds, 11:12015 (J;US)
Biological Localization
Physicochemical rationale for the biological activity of mercury and its compounds, 11:12015 (J;US)
Capacitance
Effect of microscopic structure of metal electrode on capacitance of metal - molten salt interface, 11:11519 (R;IT)
Dimers
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
Dose-Response Relationships
Physicochemical rationale for the biological activity of mercury and its compounds, 11:12015 (J;US)
Photoionization
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
Spectral Shift
High-resolution absorption spectrum of the $6^1S_0 \rightarrow 6^3P_1$ transition in mercury with a Cw dye laser, 11:12092 (R;US)

MESIC ATOMS
Elastic Scattering
Measurement of the pμ-atom scattering cross section in gaseous hydrogen, 11:12087 (R;SU;In Russian)

MESOATOMS
See MESIC ATOMS

MESON RESONANCES
See also CHARMED MESON RESONANCES
D-1285 RESONANCES
DELTA-966 RESONANCES
E-1422 RESONANCES
IOTA-1440 RESONANCES
VECTOR MESONS
Hadronic Particle Decay
Exclusive decays of heavy mesons into baryons, 11:12215 (J;NL)

MESON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

MESONS
See also MESON RESONANCES
POMERANCHUK PARTICLES
SCALAR MESONS
Form Factors
Lattice results on the meson electric form factor, 11:12254 (R;CA)
Pair Production
Antinucleon nucleon annihilations into two mesons, 11:12156 (R;FR)
Weak Hadronic Decay
Lattice calculation of weak matrix elements, 11:12212 (J;US)

METAGALAXY
See UNIVERSE

METAL BUILDINGS
See PREFABRICATED BUILDINGS

METALS
See also ACTINIDES
ALKALI METALS
ALKALINE EARTH METALS
ALUMINIUM
GERMANIUM
LEAD
LIQUID METALS
MERCURY
RARE EARTHS
REFRACTORY METALS
TIN
ZINC
Annealing
Grain growth in three dimensions: a lattice model, 11:11546 (J;US)
Crystal Lattices
Grain growth in three dimensions: a lattice model, 11:11546 (J;US)
Deformation
Crystal plasticity analysis of large-strain shear, 11:11529 (R;US)
Fracture Properties
Method for producing hard-surfaced tools and machine components, 11:11541 (P;US)
Grain Growth
Grain growth in three dimensions: a lattice model, 11:11546 (J;US)
Ion Implantation
Method for producing hard-surfaced tools and machine components, 11:11541 (P;US)
Microhardness
Method for producing hard-surfaced tools and machine components, 11:11541 (P;US)
Photoelectric Emission
Study of the interaction of light with sub-micron metallic surfaces. Progress report, 11:12080 (R;US)
Surface Properties
Method for producing hard-surfaced tools and machine components, 11:11541 (P;US)

METAL-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS

METASTABLE STATES
For atomic and molecular states only; for nuclear states use ISOMERIC NUCLEI.
Radiationless Decay
Quantum decay rate of metastable phase in (1 + 1) dimensions, 11:12408 (R;SU)

METEOROLOGY
Measuring Instruments
Meteorological equipment and records, 11:11879 (BA;US)

METHANATION
Catalysis
Experimental study of coal ash catalyzed reactions between carbon monoxide and hydrogen, 11:10759 (RA;US)

METHANE
Chemical Reactions
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)
Fuel Substitution
Converting an agricultural tractor to biogas turbojet operation, 11:11486 (RA;DE;In German and English)
Photoacoustic Spectroscopy
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)

Production
Use of appropriate technologies for biomass waste conversion in small communities, 11:11126 (RA;PR)
Viscosity
Thermophysical properties correlations and pseudocomponent characterization parameter estimation for fossil fluids. First quarterly report (III year), September 1-November 30, 1985, 11:11674 (R;US)
Yields
Low-temperature thermochemical conversion of high-moisture biomass feedstocks, 11:11132 (R;US)

METHANE HYDRATE DEPOSITS
See NATURAL GAS HYDRATE DEPOSITS

METHANE HYDRATES
See GAS HYDRATES

METHANOGENIC BACTERIA
Biochemistry
One carbon metabolism in anaerobic bacteria: organic acid and methane production. Final technical report, 11:11129 (R;US)

METHANOL
Adsorption Heat
Characterization of coal surfaces. Technical progress report, August 21-November 20, 1985, 11:10856 (R;US)
Cost
Panama coal to methanol project. Phase I. Feasibility Study. Technical progress report, 11:11140 (R;US)
Photochemical Reactions
Assessment of photochemical applications to specific stages in Savannah River Plant actinide reprocessing streams, 11:10988 (R;US)
Prices
Panama coal to methanol project. Phase I. Feasibility Study. Technical progress report, 11:11140 (R;US)
Production
Economic evaluation of methanol and SNG production using UCG, 11:10755 (RA;US)
Resource Potential
Alcohols and ideas for savings of petroleum crude at local refineries in the Caribbeans, 11:11136 (RA;PR)
Retention
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
Solvent Properties
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
Synthesis
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985, 11:11142 (R;US)
Panama coal to methanol project. Phase I. Feasibility Study. Technical progress report, 11:11140 (R;US)

METHANOL PLANTS
Economic Analysis
Panama coal to methanol project. Phase I. Feasibility Study. Technical progress report, 11:11140 (R;US)
Feasibility Studies
Panama coal to methanol project. Phase I. Feasibility Study. Technical progress report, 11:11140 (R;US)

METHANOTROPHIC BACTERIA
Biochemistry
One carbon metabolism in anaerobic bacteria: organic acid and methane production. Final technical report, 11:11129 (R;US)

METHOXYBENZENE
See ANISOLE

METHYL ALCOHOL
See METHANOL

METHYL IODIDE
Adsorption
Application of silver-free zeolites to remove iodine from dissolver off-gases in spent fuel reprocessing plants, 11:11021 (RA;XA)

METHYL ISOBUTYL KETONE
Hydrogenation
Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)

METHYL PHENOLS
See CRESOLS

METHYL PHENYL ETHER
See ANISOLE

METHYL PHENYL KETONE
See ACETOPHENONE

METHYL RADICALS
Chemical Preparation
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)

METHYL VIOLOGEN
See BIPYRIDINES

METHYLBENZENE
See TOLUENE

METHYL-FUEL
See ALCOHOLS
METHANOL

METHYLMERCURY
Biological Effects
Physicochemical rationale for the biological activity of mercury and its compounds, 11:12015 (J;US)
Biological Localization
Physicochemical rationale for the biological activity of mercury and its compounds, 11:12015 (J;US)
Dose-Response Relationships
Physicochemical rationale for the biological activity of mercury and its compounds, 11:12015 (J;US)

MEXICO
Fuel Supplies
Firewood versus alternatives: domestic fuel in Mexico. Occasional paper, 11:11150 (R;GB)
Wood Fuels
Firewood versus alternatives: domestic fuel in Mexico. Occasional paper, 11:11150 (R;GB)

MHD GENERATORS
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)

MIBK
See METHYL ISOBUTYL KETONE

MICE
Biological Radiation Effects
Immunologic and hematologic perturbations in models of combined injury, 11:11989 (R;US)
Injuries
Immunologic and hematologic perturbations in models of combined injury, 11:11989 (R;US)
Irradiation
Comparison of Schistosoma mansoni migration patterns in normal and irradiated cercaria-immunized mice by means of autoradiographic analysis. Evidence that worm elimination occurs after the skin phase in immunized mice, 11:11987 (R;US)
Murine immunization by cesium-137 irradiation attenuated Schistosoma mansoni cercariae, 11:11992 (R;US)
Lethal Irradiation
Recovery of aerobic and anaerobic bacteria from irradiated mice, 11:11990 (R;US)

MICELLAR SYSTEMS
Solvent Properties
Removal of n-alcohols from an aqueous stream using micellar-enhanced ultrafiltration, 11:11672 (R;US)
X-Ray Diffraction
X-neutron comparative study of direct ionic micelles, 11:12381 (R;FR)

MICROBIAL FLORA
See MICROORGANISMS

MICROCOMPUTERS
See MICROPROCESSORS

MICRODOSIMETRY
Energy Spectra
Microdosimetry of gamma and neutron radiation. State-of-the-art and recent experimental data, 11:12390 (RA;AT)

MICROFLORA
See MICROORGANISMS

MICRONESIA
Water Treatment Plants
Development of design criteria for waste stabilization ponds in the Western Pacific Islands, 11:11481 (RA;PR)
MICROORGANISMS
See also VIRUSES
Metabolism
Anaerobic biogeochemical processes in the subsurface. Subsurface transport program, interactive seminar series, 11:11894 (R;US)
MICROPROCESSORS
Operation
IBM PC-based spectrometer control system, 11:11817 (RA;US)
MICROSCOPES
See also OPTICAL MICROSCOPES
Uses
Soft X-ray imaging with axisymmetry microscope and electronic readout, 11:12426 (R;FR)
MICROTUBULES
Physiology
Are cortical microtubules essential for cell formation and cell division by isolated callus protoplasts?, 11:11960 (RA;US)
MICROWAVE AMPLIFIERS
Efficiency
Generalized nonlinear harmonic gyrotron theory, 11:11777 (J;US)
Nonlinear Problems
Generalized nonlinear harmonic gyrotron theory, 11:11777 (J;US)
MICROWAVE EQUIPMENT
See also HETERODYNE RECEIVERS
MICROWAVE AMPLIFIERS
SQUID DEVICES
Radiometers
Use of airborne microwave radiometry for the detection and investigation of oil slicks at sea, 11:10939 (R;US)
MICROWAVE HEATING
Power Range 10-100 kW
Power balance in ELMO Bumpy Torus: bulk electrons and ions in a 37 kW discharge, 11:12447 (R;US)
MICROWAVE RADIATION
Conversion
Electron heating caused by parametrically driven turbulence near the critical density, 11:12509 (J;US)
MIGRATION (RADIONUCLIDE)
See RADIONUCLIDE MIGRATION
MILITARY EQUIPMENT
Petroleum Products
USAWC (United States Army War College) military studies program paper. Petroleum management in support of combat forces. Student essay, 11:11374 (R;US)
MILITARY FACILITIES
Petroleum Products
USAWC (United States Army War College) military studies program paper. Petroleum management in support of combat forces. Student essay, 11:11374 (R;US)
Research Programs
Armed Forces Radiobiology Research Institute annual research report, Fiscal Year 1984, 11:11986 (R;US)
MILK
Radiation Monitoring
Environmental Radiation Data report 30, April-June 1982. Quarterly report, 11:11885 (R;US)
Environmental Radiation Data report 29: January-March 1982, 11:11883 (R;US)
Environmental Radiation Data report 28: October-December 1981, 11:11884 (R;US)
MILL TAILINGS
Coverings
Protection of uranium tailings impoundments against overland erosion, 11:11026 (R;US)
Forecasting
Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1, 11:11005 (R;US)
Inventories
Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1, 11:11005 (R;US)
Remedial Action
Annual status report on the Uranium Mill Tailings Remedial Action Program, 11:11003 (R;US)
Research Programs
Annual status report on the Uranium Mill Tailings Remedial Action Program, 11:11003 (R;US)
MILLSTONE-3 REACTOR
Waterford, Connecticut, USA
Auxiliary Systems
Safety Evaluation Report related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423). Supplement No. 4, 11:11324 (R;US)
Containment Systems
Safety Evaluation Report related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423). Supplement No. 4, 11:11324 (R;US)
Engineered Safety Systems
Safety Evaluation Report related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423). Supplement No. 4, 11:11324 (R;US)
Reactor Components
Safety Evaluation Report related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423). Supplement No. 4, 11:11324 (R;US)
Reactor Control Systems
Safety Evaluation Report related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423). Supplement No. 4, 11:11324 (R;US)
Reactor Cooling Systems
Safety Evaluation Report related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423). Supplement No. 4, 11:11324 (R;US)
Reactor Instrumentation
Safety Evaluation Report related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423). Supplement No. 4, 11:11324 (R;US)
Reactor Licensing
Safety Evaluation Report related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423). Supplement No. 4, 11:11324 (R;US)
Reactor Operation
Safety Evaluation Report related to the operation of Millstone Nuclear Power Station, Unit No. 3 (Docket No. 50-423). Supplement No. 4, 11:11324 (R;US)
MINE SAFETY AND HEALTH ADMINISTRATION
See US MSHA
MINE-MOUTH GENERATING PLANTS
See COAL MINES
FOSSIL-FUEL POWER PLANTS
MINERALS
See also SILICATE MINERALS
ZEOLITES
Catalytic Effects
Liquefaction, 11:10739 (RA;US)
MINNESOTA
Federal Assistance Programs
Financial and Compliance Report on Federally Assisted Programs for the year ended June 30, 1984, 11:11376 (R;US)
MINORITY GROUPS
See also AMERICAN INDIANS
LOW INCOME GROUPS
Federal Assistance Programs
Financial and Compliance Report on Federally Assisted Programs for the year ended June 30, 1984, 11:11376 (R;US)
MISGURNUS
See FISHES
MISSISSIPPI
Radioactive Waste Disposal
Managing the nation's nuclear waste. Site descriptions: Cypress Creek, Davis Canyon, Deaf Smith, Hanford Reference, Lavender Canyon, Richton Dome, Swisher, Vacherie Dome, and Yucca Mountain, 11:11007 (R;US)
MIXED CARBIDE FUELS
Swelling
Advanced-fuel performance model Euges-Aries. Description and listing of the computer program and introduction to its use, 11:11258 (R;DE)

MOBIL M-GASOLINE PROCESS
Catalysts
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
MODELS (COSMOLOGICAL)
See COSMOLOGICAL MODELS
MODELS (MATHEMATICAL)
See MATHEMATICAL MODELS
MODELS (PLASMA)
See PLASMA SIMULATION
MODULAR COGENERATION POWER PLANTS
See DUAL-PURPOSE POWER PLANTS
MOISTURE
Removal
Nonsaturable microdryer, 11:11779 (P;US)
MOLDS
See FUNGI
MOLECULAR ORBITAL METHOD
Some considerations about bond indices in non-orthogonal bases and the MO calculation of valence and oxidation number, 11:11641 (R;BR)
MOLECULAR ORBITAL MODEL
See MOLECULES
MOLECULE-MOLECULE COLLISIONS
Excitation
State-to-state vibrational excitation of I_2 in collisions with H_2 and D_2, 11:12098 (J;US)
MOLECULES
See also POLYATOMIC MOLECULES
Chemical Reactions
Measurement of the $C_2(a^3\Pi/sub\ u/)$ and $C_2(X^1\Sigma/sub\ g/^+)$ disappearance rates with O_2 from 298 to 1300 kelvin, 11:11710 (J;US)
Positrons
Theoretical study of the binding of positrons of gaseous molecules, 11:12061 (R;US)
MOLTEN CARBONATE FUEL CELLS
Prior to June 1980 this information was indexed with the descriptors HIGH-TEMPERATURE FUEL CELLS + MOLTEN SALTS + CARBONATES.
Research Programs
Development of molten carbonate fuel cell technology. Technical progress report for the quarter January-March 1985, 11:11407 (R;US)
MOLTEN METAL-WATER REACTIONS
Pressure Gradients
Two-dimensional empirical model for analyzing steam explosion experiments, 11:11344 (R;US)
Risk Assessment
Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels, 11:11348 (R;US)
MOLTEN SALT COOLANTS
See MOLTEN SALTS
MOLTEN SALT FUELED REACTORS
Reactor Safety
Ultimate Safe (US) Reactor, 11:11300 (R;US)
MOLTEN SALTS
Capacitance
Effect of microscopic structure of metal electrode on capacitance of metal - molten salt interface, 11:11519 (R;IT)
MOLYBDENUM
Biological Effects
Essential trace metals in man: molybdenum, 11:12012 (J;US)
Catalytic Effects
Catalytic hydrotreatment studies with model compounds. Quarterly report, October 1, 1985-December 31, 1985, 11:10781 (R;US)
Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)
Corrosion
Effect of oxygen concentration on the corrosion of molybdenum in flowing water, 11:11788 (R;US)
Electrochemistry
Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)
Ion Collisions
Ultrahigh-resolution studies of heavy-ion induced X-ray satellite emission, 11:12114 (J;NL)
Ion Exchange Chromatography
Separation and purification of fission products from process streams of irradiated nuclear fuel, 11:11022 (RA;XA)
Oxidation
Catalytic hydrotreatment studies with model compounds. Quarterly report, October 1, 1985-December 31, 1985, 11:10781 (R;US)
Time-resolved Auger electron spectroscopy combined with modulated molecular beam techniques for gas-surface reaction kinetics studies, 11:11662 (J;NL)
Physical Radiation Effects
Ultrahigh-resolution studies of heavy-ion induced X-ray satellite emission, 11:12114 (J;NL)
Stability
Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)
Sulfidation
Catalytic hydrotreatment studies with model compounds. Quarterly report, October 1, 1985-December 31, 1985, 11:10781 (R;US)
Tissue Distribution
Essential trace metals in man: molybdenum, 11:12012 (J;US)
MOLYBDENUM 100
Beta Decay
Experiment to measure nuclear double - β decay, 11:12149 (RA;US)
MOLYBDENUM 100 TARGET
Argon 40 Reactions
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
MOLYBDENUM OXIDES
Catalytic Effects
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)
Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985, 11:10785 (R;US)
MONGRELS
See DOGS
MONITORED RETRIEVABLE STORAGE
Safeguard Regulations
Safeguards and security design guidelines for conceptual Monitored Retrievable Storage (MRS) facilities, 11:11085 (J;US)
Security
Safeguards and security design guidelines for conceptual Monitored Retrievable Storage (MRS) facilities, 11:11085 (J;US)
MONITORING
Use of a more specific term is recommended.
See also BEAM MONITORING
LOOSE PARTS MONITORING
Management
Guidance document for prioritizing supplemental monitoring around synfuels facilities, 11:10922 (R;US)
MONITORING (BEAM)
See BEAM MONITORING
MONITORING NETWORK
See MONITORING
MONITORS
See also BEAM MONITORS
RADIATION MONITORS
Design
Valve monitor designs for security applications, 11:11089 (J;US)
MONITORS (BEAM)
See BEAM MONITORS
MONITORS (RADIATION)
See RADIATION MONITORS
MONITORS (REACTOR)
See REACTOR CONTROL SYSTEMS
MONOCARBOXYLIC ACIDS
See also ACETIC ACID
ACRYLIC ACID

BENZOIC ACID
FORMIC ACID
Diagnostic Uses
Structurally modified fatty acids - clinical potential as tracers of metabolism, 11:11972 (R;US)
MONOCLONAL ANTIBODIES
Labelling
Chemoradiotherapy of cancer: boronated antibodies and boron-containing derivatives of promazine and porphyrins for neutron capture therapy. Progress report, November 1984-October 1985, 11:11973 (R;US)
MONOCRYSTALS
Orientation
Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
MONTAN WAXES
See WAXES
MORBIDITY
See DISEASE INCIDENCE
MORTALITY
Mathematical Models
Health effects model for nuclear power plant accident consequence analysis. Part I. Introduction, integration, and summary. Part II. Scientific basis for health effects models, 11:11997 (R;US)
MOSFET
Metal Oxide Silicon Field Effect Transistors.
Physical Radiation Effects
Simple technique for separating the effects of interface traps and trapped-oxide charge in metal-oxide-semiconductor transistors, 11:11778 (J;US)
Trapping
Simple technique for separating the effects of interface traps and trapped-oxide charge in metal-oxide-semiconductor transistors, 11:11778 (J;US)
MOTION DETECTION SYSTEMS
Simulation
Example motion sensor test results using the Sandia Intruder Motion Simulator, 11:11104 (J;US)
Simulators
Motion sensor evaluation using simulation, 11:11103 (J;US)
MUCOPOLYSACCHARIDES
See also CHITIN
Biosynthesis
Model for the mechanism and regulation of chitosan synthesis in Mucor rouxii, 11:11936 (RA;US)
MULTICHARGED IONS
Ions with charge 3 and above. Coordinate the above descriptor with a descriptor for the specific ion.
Electron Collisions
Ionization from the sublevels nl with n = 5 and 6 in highly charged ions, 11:12125 (J;GB)
Electron-Ion Collisions
Indirect processes in electron impact ionization of multiply-charged ions, 11:12106 (J;NL)
Ion-Atom Collisions
Correlated two electron effects in collisions of multiply-charged Au ions with He, 11:12107 (J;NL)
Ionization
Ionization from the sublevels nl with n = 5 and 6 in highly charged ions, 11:12125 (J;GB)
MULTI-PHOTON PROCESSES
Landau-Zener Formula
Kinetic studies following state selective laser excitation. Progress report, March 15, 1985-March 14, 1986, 11:12078 (R;US)
MULTIPROCESSORS
See ARRAY PROCESSORS
MULTIWIRE DRIFT CHAMBERS
See DRIFT CHAMBERS
MUNICIPAL BUILDINGS
See PUBLIC BUILDINGS
MUNICIPAL WASTES
Anaerobic Digestion
Use of appropriate technologies for biomass waste conversion in small communities, 11:11126 (RA;PR)
Combustion
Energy from wastes, current technology, 11:11147 (RA;PR)
Planning waste-to-energy plants in Puerto Rico, 11:11146 (RA;PR)
Electrolysis
Products found in the anodic oxidation of coal, 11:11122 (J;GB)
Fluidized-Bed Combustors
Investigation of fluid-bed combustion of municipal solid waste, 11:11483 (R;US)
Incinerators
Investigation of fluid-bed combustion of municipal solid waste, 11:11483 (R;US)
Leaching
Mobility of organic and inorganic constituents from energy and combustion-related wastes under codisposal conditions, 11:11484 (J;US)
Pyrolysis
Energy from wastes, current technology, 11:11147 (RA;PR)
MUON REACTIONS
Capture
Radiative muon capture on ^{16}O, 11:12303 (R;SU;In Russian)
Deep Inelastic Scattering
Deep inelastic muon scattering at Fermilab - status report, 11:12148 (RA;US)
MUONIC ATOMS
Heavy Ion Fusion Reactions
Muon catalyzed fusion - fission reactor driven by a recirculating beam, 11:12494 (R;US)
MUONIUM
Chemical Preparation
Muonium formation in vapors, 11:12091 (R;CA)
Chemical Reaction Kinetics
Muonium addition reactions to aromatic solutes. Application of the Hammett equation in the production of muonium-radicals, 11:12090 (R;CA)
MUONS
See also COSMIC MUONS
MUONS PLUS
Pair Production
PLUTO collaboration: e^+e^- interactions at PETRA, 11:12147 (RA;US)
Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)
Particle Production
D/sub phi/ experiment at TeV I, 11:12153 (RA;US)
MUONS PLUS
Leptonic Decay
Progress report on recent rare muon decay experiments at the Los Alamos meson physics facility, 11:12169 (J;NL)
Radiative Decay
Progress report on recent rare muon decay experiments at the Los Alamos meson physics facility, 11:12169 (J;NL)
MUSCLES
See also MYOCARDIUM
Activation Analysis
Study and application of ion chromatography and activation analysis without chemical separation for the determination of sodium and potassium in muscle tissues, 11:11615 (R;BR;In Portuguese)
MUSCULAR TISSUE
See MUSCLES
TISSUES
MYOCARDIUM
Scintiscanning
Structurally modified fatty acids - clinical potential as tracers of metabolism, 11:11972 (R;US)

N

N CODES
Documentation
NEPTUNE: a finite element code for creeping flow of saturated cohesive porous media (Version 1.0), 11:12035 (R;US)
NAI DETECTORS
Efficiency
Efficiency and response of the total energy counter, 11:11819 (RA;US)
NAL SYNCHROTRON
See FERMILAB ACCELERATOR
NAPHTHA
Boiling point range 0-204° C.
Carcinogen Screening
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Chemical Properties
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Mutagen Screening
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
Physical Properties
Toxicological beneficiation of coal liquids and comparison with petroleum products, 11:10919 (R;US)
NAPHTHALENE
Molecular Structure
Studies of metal ammonia interactions with aromatic substrates. Final report, December 18, 1979-February 28, 1985, 11:11671 (R;US)
Oxidation
Oxidation of arenes by molten gallium(III) chloride, 11:11696 (J;GB)
Raman Spectroscopy
Multiresonant four-wave mixing spectroscopy of pentacene in naphthalene, 11:11688 (J;US)
Reduction
Studies of metal ammonia interactions with aromatic substrates. Final report, December 18, 1979-February 28, 1985, 11:11671 (R;US)
Stereochemistry
Studies of metal ammonia interactions with aromatic substrates. Final report, December 18, 1979-February 28, 1985, 11:11671 (R;US)
Supercritical Fluid Chromatography
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)
Supercritical Gas Extraction
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985, 11:11142 (R;US)
NATIONAL ACCELERATOR LABORATORY
See FERMILAB ACCELERATOR
NATIONAL DEFENSE
Radioactive Waste Management
Defense radioactive waste management activities: an overview, 11:11050 (J;US)
NATIONAL REACTOR TESTING STATION
See IDAHO NATIONAL ENGINEERING LABORATORY
NATIONAL SYNCHROTRON LIGHT SOURCE
See NSLS
NATURAL GAS
See also LIQUEFIED NATURAL GAS
Bids
SIMBID: An alternative, simplified model of bidding and awarding of new natural gas reserves, 11:10960 (R;US)
Cocombustion
Coal-water mixture firing in an industrial package boiler: a user's perspective, 11:10887 (RA;US)
Consumption Rates
Model of the use of coal, gas, and oil (Brookhaven Energy System Optimization Model (BESOM)), 11:11398 (J;GB)
Demand
Modeling residential natural gas demand at the state level, 11:10959 (R;US)
SIMBID: An alternative, simplified model of bidding and awarding of new natural gas reserves, 11:10960 (R;US)
Energy Models
Modeling residential natural gas demand at the state level, 11:10959 (R;US)
Exports
Natural Gas Annual, 1984. Volume I, 11:10962 (R;US)
Fuel Consumption
Natural Gas Monthly, October 1985 (Contains glossary), 11:10961 (R;US)
Natural Gas Annual 1984. Volume II, 11:10963 (R;US)
Natural Gas Annual, 1984. Volume I, 11:10962 (R;US)
Imports
Natural Gas Annual, 1984. Volume I, 11:10962 (R;US)
Prices
Natural Gas Monthly, October 1985 (Contains glossary), 11:10961 (R;US)
Natural Gas Annual, 1984. Volume I, 11:10962 (R;US)
Production
Natural Gas Monthly, October 1985 (Contains glossary), 11:10961 (R;US)
Natural Gas Annual, 1984. Volume I, 11:10962 (R;US)
Reserves
Natural Gas Annual, 1984. Volume I, 11:10962 (R;US)
SIMBID: An alternative, simplified model of bidding and awarding of new natural gas reserves, 11:10960 (R;US)
Sales
Natural Gas Monthly, October 1985 (Contains glossary), 11:10961 (R;US)
Storage
Natural Gas Annual, 1984. Volume I, 11:10962 (R;US)
Underground Storage
Natural Gas Monthly, October 1985 (Contains glossary), 11:10961 (R;US)
NATURAL GAS DEPOSITS
Leases
Final environmental impact statement: proposed central Gulf of Mexico OCS Lease Sale 104 (April 1986) and proposed western Gulf of Mexico OCS Lease Sale 105 (July 1986), 11:10964 (R;US)
Final environmental impact statement: proposed Norton Basin Lease Sale 100. Volume 1, 11:10938 (R;US)
NATURAL GAS DISTRIBUTION SYSTEMS
Fuel Supplies
SIMBID: An alternative, simplified model of bidding and awarding of new natural gas reserves, 11:10960 (R;US)
Management
SIMBID: An alternative, simplified model of bidding and awarding of new natural gas reserves, 11:10960 (R;US)
NATURAL GAS GATHERING SYSTEMS
See NATURAL GAS DISTRIBUTION SYSTEMS
NATURAL GAS HYDRATE DEPOSITS
Drill Cores
Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)
Exploration
Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)
Sampling
Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)
Seismic Surveys
Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)
NAVAL PETROLEUM RESERVE
Analysis of the potential for enhanced oil recovery in the Shannon Formation at Naval Petroleum Reserve Number 3. Master's thesis, 11:10930 (R;US)
Cost Recovery
Audit of joint owner costing and billing practices, Naval Petroleum Reserve No. 1, Elk Hills, California, 11:12515 (R;US)
NEGATIVE IONS
See ANIONS
NEGATONS
See ELECTRONS

NEGATRONS
See ELECTRONS
NEODYMIUM
Ion-Atom Collisions
L-shell X-ray production cross sections in Nd, Gd, Ho, Yb, Au and Pb for 25-MeV carbon and 32-MeV oxygen ions, 11:12110 (J;NL)
NEODYMIUM 140
Moment of Inertia
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
Rotational States
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
NEODYMIUM LASERS
Beam Profiles
Holographic wavefront characterization of a frequency-tripled high-peak-power neodymium:glass laser (Near-field, λ = 351 nm), 11:11756 (R;US)
Design
[Glass Development Laser (GDL) Facility upgrade.] LLE Review. Quarterly report, October-December 1984. Volume 21, 11:12487 (R;US)
Laser Materials
An active mode-locked Q-switched oscillator using Nd^{3+} doped glass as the active medium, 11:11761 (J;US)
Mode Locking
An active mode-locked Q-switched oscillator using Nd^{3+} doped glass as the active medium, 11:11761 (J;US)
Oscillators
An active mode-locked Q-switched oscillator using Nd^{3+} doped glass as the active medium, 11:11761 (J;US)
Q-Switching
An active mode-locked Q-switched oscillator using Nd^{3+} doped glass as the active medium, 11:11761 (J;US)
NEODYMIUM OXIDES
Chemical Preparation
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-0.5x/ system, 11:11651 (J;US)
Lattice Parameters
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-0.5x/ system, 11:11651 (J;US)
Neutron Diffraction
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-0.5x/ system, 11:11651 (J;US)
X-Ray Diffraction
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/(SiO$_4$)$_6$O/sub 2-0.5x/ system, 11:11651 (J;US)
NEON
Ion-Atom Collisions
Auger electron spectra in 5.5 MeV/amu Nesup(q+) and Arsup(q+) ion impact on Ne, 11:12086 (R;SU)
Time dependent Hartree-Fock theory of ion-atom collisions: Application to F^{9+} + Ne, 11:12103 (J;NL)
Neutrino Reactions
Limits on like-sign dilepton production in ν/sub μ/ interactions, 11:12166 (J;US)
NEON 20 REACTIONS
Inelastic Scattering
Observation of a long-lived nuclear quasimolecule in the ^{20}Ne + Ge system, 11:12324 (R;SU;In Russian)
Neutron Emission
Fast neutron emission in interaction of 9 MeV/nucleon ^{12}C and ^{20}Ne ions with ^{181}Ta nuclei, 11:12338 (R;SU;In Russian)
Particle Production
π^+ and π^- production in the α-nucleus and nucleus-nucleus collisions between 200 and 800 MeV/nucleon, 11:12342 (R;FR;In French)
Precompound-Nucleus Emission
Fast neutron emission in interaction of 9 MeV/nucleon ^{12}C and ^{20}Ne ions with ^{181}Ta nuclei, 11:12338 (R;SU;In Russian)
Rutherford Scattering
Observation of a long-lived nuclear quasimolecule in the ^{20}Ne + Ge system, 11:12324 (R;SU;In Russian)
NEON IONS
Auger Electron Spectroscopy
Auger electron spectra in 5.5 MeV/amu Nesup(q+) and Arsup(q+) ion impact on Ne, 11:12086 (R;SU)
Ion-Atom Collisions
Auger electron spectra in 5.5 MeV/amu Nesup(q+) and Arsup(q+) ion impact on Ne, 11:12086 (R;SU)
P States
Alignment of the 2P-states of He-like Ne recoil ions produced by 1.35 MeV/a.m.u. Ar ion impact, 11:12071 (RA;US)
Delayed emission of 2p-1s and 3p-1s X-rays from 40 MeV neon ions ionized in a thin carbon foil, 11:12073 (RA;US)
X-Ray Spectra
Spectroscopy of Ldagger-series transitions for x-ray laser photopumping, 11:11760 (J;US)
NEOPLASMS
Disease Incidence
Scientific Committee 71 on radiation exposure and potentially-related injury, 11:12004 (BA;US)
Epidemiology
Progress in indoor radon measurement. Review of previous research (July 1981-February 1985), 11:11881 (R;US)
Necrosis
Two-dimensional diffusion limited system for cell growth, 11:11985 (R;US)
Risk Assessment
Internal emitter limits for iodine, radium and radon daughters, 11:12002 (BA;US)
NEPTUNIUM
Extraction Chromatography
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinide elements, 11:11613 (RA;XA)
Radionuclide Migration
Laboratory simulation of radionuclide geological migration, 11:11068 (RA;US)
Source term modelling in the Swedish KBS - 3 study, 11:11063 (RA;US)
Redox Reactions
Chemical properties of neptunium applied to neptunium management in extraction cycles of Purex process, 11:10984 (R;FR)
NEPTUNIUM 237
Delayed Neutron Analysis
Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel, 11:11108 (J;US)
NEPTUNIUM PHOSPHATES
Chemical Preparation
Synthesis and characterization of crystalline phosphate of thorium, uranium and neptunium, 11:11725 (J;CH)
Quantitative Chemical Analysis
Synthesis and characterization of crystalline phosphate of thorium, uranium and neptunium, 11:11725 (J;CH)
NERVES
Electrophysiology
Biological studies of swine exposed to 60-Hz electric fields. Volume 7. Neurology. Final report, 11:12023 (R;US)
NEUTRAL ATOM BEAM INJECTION
Beam Shaping
ATF neutral beam injection: optimization of beam alignment and aperturing, 11:12497 (R;US)
Computerized Simulation
ATF neutral beam injection: optimization of beam alignment and aperturing, 11:12497 (R;US)
Energy Losses
ATF neutral beam injection: optimization of beam alignment and aperturing, 11:12497 (R;US)
NEUTRALIZATION (BEAM)
See BEAM NEUTRALIZATION
NEUTRALIZATION (PHYSICAL)
See RECOMBINATION

NEUTRINO OSCILLATION
Indication of neutrino oscillation from the Bugey experiment, 11:12160 (R;FR)
Physics with underground leptons of atmospheric origin, 11:12173 (J;US)
Recent results from the Bugey neutrino oscillation experiment, 11:12159 (R;FR)
NEUTRINO REACTIONS
Charged-Current Interactions
Limits on like-sign dilepton production in ν/sub μ/ interactions, 11:12166 (J;US)
NEUTRINO-ELECTRON INTERACTIONS
Elastic Scattering
Elastic nu/sub e/ e scattering at LAMPF, 11:12150 (RA;US)
First observation and cross-section measurement of ν/sub e/+e^-→ν/sub e/+e^-, 11:12168 (J;US)
NEUTRINO-NUCLEON INTERACTIONS
Pair Production
Same-sign dilepton production by neutrinos, 11:12141 (R;US)
NEUTRINOS
See also COSMIC NEUTRINOS
SOLAR NEUTRINOS
CP Invariance
CP violation with three generations of Majorana neutrinos, 11:12207 (R;CA)
Mass
Rate suppression with three generations of Majorana neutrinos, 11:12208 (R;CA)
NEUTRON ACTIVATION ANALYSIS
See ACTIVATION ANALYSIS
NEUTRON REACTIONS
NEUTRON CAPTURE
See CAPTURE
NEUTRON REACTIONS
NEUTRON CAPTURE THERAPY
Microanalytical techniques for boron analysis using the ^{10}B(n,α)^{7}Li reaction, 11:11981 (J;US)
NEUTRON DETECTION
Dielectric Track Detectors
Present status of neutron detection in ATOMKI, 11:11831 (RA;AT)
NEUTRON DIFFRACTION
Fourier Analysis
Fourier-filtering techniques for the analysis of high-resolution pulsed neutron powder diffraction data, 11:11557 (R;US)
NEUTRON DOSIMETRY
Dosemeters
Possible secondary standard for lethal dose measurements in radiological research and accident dosimetry, 11:11827 (RA;AT)
NEUTRON MATTER
See NUCLEAR MATTER
NEUTRON MONITORS
Calibration
Calibration of an NDA neutron monitor for determining process holdup, 11:11087 (J;US)
Design
Calibration of an NDA neutron monitor for determining process holdup, 11:11087 (J;US)
NEUTRON REACTIONS
Capture
Correlation between the partial cross sections for the ^{174}Yb(n,2γ)^{175}Yb and ^{176}Yb(d,t)^{175}Yb reactions, 11:12335 (R;SU;In Russian)
Effect of the choice of scattering data, bound or unbound, and the energy group structure on the calculated absorptions in the 1 eV Pu-240 resonance, 11:12347 (R;CA)
Neutron-capture cross-section measurements for ^{115}In and ^{197}Au in the energy region 2.0-7.7 MeV, using the activation technique, 11:12331 (R;SE)
Resonance neutron capture by manganese below 2.5 keV, 11:12322 (J;US)
Cross Sections
Neutron scattering and reactions on 59Co from 1 to 20 MeV, 11:12323 (R;GB)
Elastic Scattering
Low-energy optical-model analysis of ^{208}Pb and ^{209}Bi, 11:12345 (J;NL)
Fission
Neutron-induced fission cross-section measurements of ^{244}Cm, ^{246}Cm, and ^{248}Cm, 11:12355 (J;US)
Inelastic Scattering
Low-energy optical-model analysis of ^{208}Pb and ^{209}Bi, 11:12345 (J;NL)
Monte Carlo Method
A reevaluation of the ^{9}Be(n,2n) reaction and its effect on neutron multiplication in fusion blanket applications, 11:12309 (J;US)
Multiplication Factors
A reevaluation of the ^{9}Be(n,2n) reaction and its effect on neutron multiplication in fusion blanket applications, 11:12309 (J;US)
Nuclear Data Collections
A reevaluation of the ^{9}Be(n,2n) reaction and its effect on neutron multiplication in fusion blanket applications, 11:12309 (J;US)
Research Programs
Triangle Universities Nuclear Laboratory annual report - TUNL XXIV, 1 July 1984-31 August 1985, 11:12275 (R;US)
Resonance
Resonance neutron capture by manganese below 2.5 keV, 11:12322 (J;US)
NEUTRON SOURCES
Excludes reactors even when used as neutron sources.
Recommendations
Major facilities for materials research and related disciplines. Final report, 11:11118 (R;US)
NEUTRON SPECTROMETERS
Computerized Control Systems
Portable neutron spectrometer and dosimeter, 11:11838 (P;US)
Design
Portable neutron spectrometer and dosimeter, 11:11838 (P;US)
NEUTRON TRANSPORT
Neutron Spectra
Monte Carlo and discrete ordinates calculations for 14-MeV neutrons streaming through a stainless steel duct: comparisons with Experiment II, 11:12498 (R;US)
NEUTRON TRANSPORT THEORY
Algorithms
Vectorization and multitasking with a Monte-Carlo code for neutron transport problems, 11:12382 (R;FR)
Monte Carlo Method
Monte Carlo and discrete ordinates calculations for 14-MeV neutrons streaming through a stainless steel duct: comparisons with Experiment II, 11:12498 (R;US)
Vector Processing
Vectorization and multitasking with a Monte-Carlo code for neutron transport problems, 11:12382 (R;FR)
NEUTRON-RICH ISOTOPES
Nuclear Structure
Recent developments at TRISTAN: nuclear structure studies of neutron-rich nuclei, 11:11792 (R;US)
NEUTRONS
Dose Equivalents
Dosimetric aspects, 11:12003 (BA;US)
Inelastic Scattering
Inelastic neutron scattering spectrum of chromous acid at high energy transfers, 11:11656 (J;US)
Particle Decay
Determination of the neutron lifetime using e-p coincidence, 11:12162 (R;US)
NEVADA
Radioactive Waste Disposal
Managing the nation's nuclear waste. Site descriptions: Cypress Creek, Davis Canyon, Deaf Smith, Hanford Reference, Lavender Canyon, Richton Dome, Swisher, Vacherie Dome, and Yucca Mountain, 11:11007 (R;US)
NEVADA TEST SITE
Radioactive Waste Management
Commercial Nuclear Waste Research and Development Program. Annual report, fiscal year 1985, 11:10989 (R;US)

NEW BRUNSWICK
Fossil-Fuel Power Plants
Cape Breton Development Corporation's CARBOGEL coal water fuel project, 11:10845 (RA;US)
NEW HAMPSHIRE
Wind Power
Community supported wind resource monitoring network, 11:11208 (RA;PR)
NEW MEXICO
Salt Deposits
Basic data report: borehole WIPP-12 deepening. Waste Isolation Pilot Plant (WIPP) Project, southeastern New Mexico, 11:11044 (R;US)
Basic data report for borehole DOE-1. Waste Isolation Pilot Plant (WIPP) Project, Southeastern New Mexico, 11:11045 (R;US)
NEWFOUNDLAND
Geochemical Surveys
Uranium in the Circum-Ungava belt, northern Quebec and Labrador. New information form the central Labrador Trough, 11:10975 (RA;CA)
NICKEL
Adsorption
Adsorption and desulfurization of thiophene on nickel(111), 11:11670 (R;US)
Catalytic Effects
Catalytic hydrotreatment studies with model compounds. Quarterly report, October 1, 1985-December 31, 1985, 11:10781 (R;US)
Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)
Low-temperature thermochemical conversion of high-moisture biomass feedstocks, 11:11132 (R;US)
Chemical Bonds
Some considerations about bond indices in non-orthogonal bases and the MO calculation of valence and oxidation number, 11:11641 (R;BR)
Ion Implantation
One MeV electron irradiation of pure nickel compared to lithium-implanted nickel, 11:11540 (J;GB)
Oxidation
Catalytic hydrotreatment studies with model compounds. Quarterly report, October 1, 1985-December 31, 1985, 11:10781 (R;US)
Physical Radiation Effects
Current research using the ANL High Voltage Electron Microscope Tandem Accelerator facility (Electron and ion irradiation), 11:11544 (J;NL)
One MeV electron irradiation of pure nickel compared to lithium-implanted nickel, 11:11540 (J;GB)
Sulfidation
Catalytic hydrotreatment studies with model compounds. Quarterly report, October 1, 1985-December 31, 1985, 11:10781 (R;US)
Valence
Some considerations about bond indices in non-orthogonal bases and the MO calculation of valence and oxidation number, 11:11641 (R;BR)
NICKEL 58 REACTIONS
Compound-Nucleus Reactions
Measurement of the ionization probability of the 1s sigma molecular orbital in half a collision at zero impact parameter, 11:12317 (R;FR)
NICKEL ALLOYS
Magnetic Fields
Temperature dependence of the ^{57}Fe hyperfine magnetic field distribution in Fe-Ni, 11:11522 (R;US)
Moessbauer Effect
Mossbauer studies on LaNi(4.7)Sn(0.3) and its hydride, 11:11411 (R;US)
Physical Radiation Effects
Amorphous phase transition in irradiated NiTi alloy (Electron irradiation and Ni and Ta ion irradiation), 11:11539 (J;GB)
NICKEL COMPLEXES
Oxidation
Redox reactivity of transition-metal phthalocyanines: ligand radical formation vs. metal center oxidation, 11:11682 (J;US)
NIOBIUM 93 TARGET
Niobium 93 Reactions
Do collective effects exist in the intra-nuclear cascade, 11:12316 (R;FR;In French)
NIOBIUM ALLOYS
See also NIOBIUM BASE ALLOYS
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
Physical Radiation Effects
Effect of irradiation and irradiation temperature on the fracture toughness of cold-worked Zr-2.5 wt percent Nb, 11:11503 (R;CA)
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
Sorptive Properties
Experimental investigation of the rate of hydrogen absorption in zirconium-2.5 wt percent niobium from steam/hydrogen mixtures at elevated temperatures. Test specifications, 11:11649 (R;CA)
NIOBIUM BASE ALLOYS
Chemical Composition
Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
Critical Field
Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
Lattice Parameters
Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
Superconductivity
Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
Transition Temperature
Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
NIOBIUM COMPOUNDS
See also NIOBIUM OXIDES
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
Physical Radiation Effects
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
NIOBIUM OXIDES
Crystal Structure
Lithium insertion in $V_3Nb_9O_{28}$. A Wadsley-Roth type phase. Technical report, June 1984-July 1985, 11:11361 (R;US)
NITELLA
Plant Growth
Cellulose synthesis inhibition, cell expansion, and patterns of cell wall deposition in Nitella internodes, 11:11961 (RA;US)
NITRIC OXIDE
NO.
Detonations
Fundamental research on explosives program, 11:11850 (J;US)
Photoacoustic Spectroscopy
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)
Research Programs
Fundamental research on explosives program, 11:11850 (J;US)
Synthesis
Environmental control technology, 11:11219 (RA;US)

NITROGEN
Interfaces
Effects of molecular organization on photophysical behavior: lifetime and steady-state fluorescence of chlorophyll a singlets in monolayers of dioleoylphosphatidylcholine at the nitrogen-water interface, 11:11687 (J;US)
Ion-Molecule Collisions
Fine structure effect on the charge transfer reaction of $Ar^+(^3P_3/sub\ //_2/sub\ ,/_1/sub\ //_2)+N_2\ (X\ ^1\Sigma^+/sub\ g/\ ,v = 0)$, 11:12099 (J;US)
Quantitative Chemical Analysis
Trace detection in gases using photoacoustic spectroscopy and Fabry-Perot interferometry, 11:11637 (D;US)
NITROGEN 14 REACTIONS
Heavy Ion Fusion Reactions
Study on particle emission in the light-heavy ion fusion reactions: ^{14}N, sup(16,18) O + ^{12}C, 11:12299 (R;BR)
NITROGEN 14 TARGET
Silicon 28 Reactions
Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 11:12308 (J;NL)
NITROGEN 15
Isotope Separation
Process design criteria for a plant producing nitrogen-15, 11:11112 (R;US)
NITROGEN DIOXIDE
NO_2.
Adsorption
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
NITROGEN NITRIDES
See NITROGEN
NITROGEN OXIDES
See also NITRIC OXIDE
NITROGEN DIOXIDE
NITROUS OXIDE
Aerosol formation from pulverized coal combustion. Quarterly report No. 7, 11:10906 (R;US)
Air Pollution Control
Environmental control technology, 11:11219 (RA;US)
Fluidized bed combustion, 11:10900 (RA;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Desorption
Laser studies of chemical dynamics at the gas-solid interface. Progress report, 11:11511 (R;US)
Leaching
Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)
Removal
Alternative method for the removal of oxides of nitrogen and sulfur from combustion processes. First quarterly technical status report, September 17-December 31, 1985, 11:10788 (R;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Reviews
NO/sub x/ formation and control in pulverized-coal flames (From both air and fuel nitrogen), 11:11221 (RA;US)
Synthesis
NO/sub x/ formation and control in pulverized-coal flames (From both air and fuel nitrogen), 11:11221 (RA;US)
NITROMETHANE
Ignition
Criteria for ignition in monopropellant engines, 11:11780 (R;US)
NITROUS OXIDE
N_2O.
Retention
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
Solvent Properties
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
NO. 2 FUEL OIL
See HEATING OILS
NONAXIAL NUCLEI
See DEFORMED NUCLEI
NONDESTRUCTIVE ANALYSIS
Data Base Management
A portable nondestructive assay measurement control system, 11:11086 (J;US)
Safeguards
Safeguarding NDA systems, 11:11106 (J;US)
NONLEPTONIC DECAY
See WEAK HADRONIC DECAY
NONLINEAR PROBLEMS
Mathematical Models
Elements of a dialogue between nonlinear models in condensed matter and biophysics, 11:12088 (R;US)
NONLINEAR SYSTEMS
See NONLINEAR PROBLEMS
NONRADIOACTIVE WASTE DISPOSAL
See WASTE DISPOSAL
NONRADIOACTIVE WASTES
See GASEOUS WASTES
LIQUID WASTES
SOLID WASTES
NORTHERN IRELAND
See UNITED KINGDOM
NOS. 4, 5, AND 6 FUEL OILS
See RESIDUAL FUELS
NOS. 5 AND 6 BURNER OILS
See RESIDUAL FUELS
NOVA FACILITY
Research Programs
Laser Program annual report 1984, 11:12505 (R;US)
NOVA SCOTIA
Coal Mines
Research oriented technological needs in the Sydney coalfield, 11:10818 (R;CA)
Strength and deformation properties of various rocks from the Springhill coal mine, Nova Scotia, 11:10821 (R;CA)
NOVO VORONEZH-3 REACTOR
See WWER-3 REACTOR
NOVO VORONEZH-5 REACTOR
See WWER-5 REACTOR
NOXSO PROCESS
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
NOZZLES
Design
Atomization of coal water mixtures, 11:10865 (RA;US)
Coal-water-fuel firing experience at Chatham #2, 11:10890 (RA;US)
Experience with the NRC burner assembly, 11:10881 (RA;US)
Performance Testing
Coal-water-fuel firing experience at Chatham #2, 11:10890 (RA;US)
Combustion technology of coal water mixtures, 11:10880 (RA;US)
Wear Resistance
Experience with the NRC burner assembly, 11:10881 (RA;US)
NRTS
See IDAHO NATIONAL ENGINEERING LABORATORY
NSLS
Computerized Control Systems
Status of the National Synchrotron Light Source upgrade, 11:11783 (R;US)
NUCLEAR ATTACKS
See NUCLEAR WEAPONS
NUCLEAR CASCADES
Collective Model
Do collective effects exist in the intra-nuclear cascade, 11:12316 (R;FR;In French)

Computerized Simulation
High Energy Transport Code HETC, 11:12373 (R;US)
NUCLEAR CONTROVERSY
See HAZARDS
NUCLEAR DATA COLLECTIONS
Proceedings of the 1982 seminar on nuclear data, 11:12279 (R;JP;JA)
Evaluation
Applied Nuclear Science Research and Development progress report, June 1, 1984-May 31, 1985, 11:12280 (R;US)
NUCLEAR DETERRENCE
Evaluation
Ingredients of deterrence. Student paper, 11:11387 (R;US)
Some thoughts on deterrence, 11:11388 (R;US)
NUCLEAR EXPLOSIONS
Specifically named single nuclear explosions are listed by name and the word EVENT, e.g., BOXCAR EVENT. All projects involving nuclear explosions are listed by the project name and the word PROJECT, e.g., PLOWSHARE PROJECT.
Environmental Effects
Behavior of explosion debris clouds, 11:11890 (BA;US)
Fallout Deposits
Residual radioactive contamination at Maralinga and Emu, 1985, 11:11898 (R;AU)
Gamma Radiation
Ionization rate measurements, 11:11852 (R;US)
Physical Radiation Effects
Ionization rate measurements, 11:11852 (R;US)
Surface Explosions
Radiological water decontamination study, 11:11918 (R;US)
Yields
L/sub g/ wave excitation and propagation with application to nuclear yield determination. Final report 1 Apr 83-31 Mar 85, 11:11854 (R;US)
NUCLEAR FACILITIES
See also FUEL FABRICATION PLANTS
FUEL REPROCESSING PLANTS
NUCLEAR POWER PLANTS
RADIOACTIVE WASTE FACILITIES
Motion Detection Systems
Motion sensor evaluation using simulation, 11:11103 (J;US)
Nuclear Materials Management
A portable nondestructive assay measurement control system, 11:11086 (J;US)
Supporting the material control and accountancy system with physical protection system features, 11:11093 (J;US)
Physical Protection Devices
Supporting the material control and accountancy system with physical protection system features, 11:11093 (J;US)
Sabotage
Valve monitor designs for security applications, 11:11089 (J;US)
Safeguards
Design and evaluation of an integrated safeguards system: principles, 11:11092 (J;US)
Safety
DOE natural phenomena hazards mitigation conference: proceedings, 11:11769 (R;US)
Security
Classification of vulnerability information, 11:11094 (J;US)
Supporting the material control and accountancy system with physical protection system features, 11:11093 (J;US)
Valve monitor designs for security applications, 11:11089 (J;US)
Security Personnel
Developing a curriculum for training nuclear protective force persons in legal matters, 11:11110 (J;US)
Protective force legal issues: the security perspective, 11:11095 (J;US)
Site Selection
Climatological data for site selection and planning, 11:11880 (BA;US)
Vulnerability
Classification of vulnerability information, 11:11094 (J;US)
NUCLEAR INDUSTRY
Personnel
Instructional skills evaluation in nuclear industry training, 11:11391 (R;US)
NUCLEAR MATERIALS DIVERSION
Monitoring alarm resolution effectiveness, 11:11091 (J;US)
NUCLEAR MATERIALS MANAGEMENT
Accounting
Comparison of retrospective testing with statistical tests in near real time materials accountancy, 11:11084 (R;GB)
Safeguarding NDA systems, 11:11106 (J;US)
Administrative Procedures
DOE oversight of facility confirmatory measurement activity, 11:11098 (J;US)
Computerized Simulation
Emphasis: an active management model, 11:11105 (J;US)
Entry Control Systems
An activated barrier for protection of special nuclear materials in vital areas, 11:11102 (J;US)
Inventories
Estimation methods for special nuclear materials holdup, 11:11088 (J;US)
The results of the NLO error propagation exercise, 11:11099 (J;US)
Losses
Monitoring alarm resolution effectiveness, 11:11091 (J;US)
Nondestructive Analysis
DOE oversight of facility confirmatory measurement activity, 11:11098 (J;US)
Safeguarding NDA systems, 11:11106 (J;US)
Planning
Emphasis: an active management model, 11:11105 (J;US)
Radiation Monitoring
DOE oversight of facility confirmatory measurement activity, 11:11098 (J;US)
Statistical Models
Estimation methods for special nuclear materials holdup, 11:11088 (J;US)
NUCLEAR MATTER
Many-Body Problem
Nuclear matter theory: a status report, 11:12379 (J;US)
Phase Transformations
Nuclear liquid-gas phase transition, 11:12374 (R;CA)
NUCLEAR MOLECULES
Observation of a long-lived nuclear quasimolecule in the ^{20}Ne + Ge system, 11:12324 (R;SU;In Russian)
NUCLEAR PHYSICS
Use only for indexing articles of very broad coverage, such as annual reviews, text books, etc.
National Program Plans
Nuclear physics program plan, 11:12274 (R;US)
Research Programs
Progress report: Physics Division, January 1-June 30, 1983, 11:12138 (R;CA)
NUCLEAR POWER
Meetings
Nuclear power in the Midwest: proceedings of the twelfth annual Illinois Energy Conference, 11:11390 (R;US)
NUCLEAR POWER PLANTS
See also UNDERGROUND NUCLEAR STATIONS
Blowdown
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
Containment Buildings
Reliability evaluation of containments including soil-structure interaction, 11:11332 (R;US)
Structural load combinations, 11:11225 (R;US)
Containment Systems
Effects of reactor core-simulant aerosols on hydrogen/air combustion, 11:11349 (R;US)
Emergency Plans
Guidelines for preparing emergency procedures for nuclear power plants, 11:11327 (R;US)
Engineered Safety Systems
Aging and service wear of check valves used in engineered safety-feature systems of nuclear power plants. Volume 1. Operating experience and failure identification, 11:11273 (R;US)

Emergency diesel generator operating experience, 1981-1983, 11:11235 (R;US)
Failures
Problems of applying the reliability theory in the nuclear power plant situation, 11:11323 (RA;CS;In Czech)
Information Systems
Information flow; a data bank preparation in nuclear power plant reliability information system, 11:11250 (RA;CS;In Czech)
Intrusion
Proposed Revision 1 to Regulatory Guide 5.62: reporting of physical security events. Draft regulatory guide and value/impact statement, 11:11264 (R;US)
Leak Testing
Leak-proofness of sealed spaces - important aspect of reliable operation of nuclear power plants, 11:11249 (RA;CS;In Slovak)
Loose Parts Monitoring
Summary of studies on methods for detecting, locating, and characterizing metallic loose parts in nuclear reactor coolant systems, 11:11229 (R;US)
Loss of Coolant
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
Meetings
Reliability of fossil-fuel and nuclear power installations, 11:11243 (R;CS;In Czech, Slovak, German and Russian)
Meltdown
Effects of reactor core-simulant aerosols on hydrogen/air combustion, 11:11349 (R;US)
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
Performance
Objective indicators of organizational performance at nuclear power plants, 11:11335 (R;US)
Personnel
Human engineering design guidelines for maintainability. Final report, 11:11314 (R;US)
Maintenance Personnel Performance Simulation (MAPPS) model. Users' Manual, 11:11328 (R;US)
Professional Personnel
Management perceptions of the Health Physics Technician job, 11:11334 (R;US)
Nuclear Studies Training Program. Final report, 11:12513 (R;US)
Pumps
Reliability of power plant supply pumps and special valves, 11:11272 (RA;CS;In Czech)
Reactor Accidents
Consideration of resource privation by severe reactor accidents, 11:11356 (J;US)
Reactor Components
Utility machinery vibration monitoring guide (Interim), 11:11226 (R;US)
Reactor Core Disruption
Comparison of methods applicable to evaluation of nuclear power plant technical specifications, 11:11294 (R;US)
Reactor Cores
Effects of reactor core-simulant aerosols on hydrogen/air combustion, 11:11349 (R;US)
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
Reactor Maintenance
Human engineering design guidelines for maintainability. Final report, 11:11314 (R;US)
Reactor Operation
Event tree and its application in analysis of nuclear power plant operating states, 11:11228 (RA;CS;In Czech)
Reactor Operators
Nuclear Studies Training Program. Final report, 11:12513 (R;US)
Reactor Safety
Objective indicators of organizational performance at nuclear power plants, 11:11335 (R;US)
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
Role of experts in the safety and reliability of nuclear installations. Analysis of situation in the Federal Republic of Germany, 11:11316 (RA;CS;In German)
Reliability
Information flow; a data bank preparation in nuclear power plant reliability information system, 11:11250 (RA;CS;In Czech)
Monitoring and assessment of reliability of power installations in Vitkovice Concern, 11:11247 (RA;CS;In Czech)
Problems of applying the reliability theory in the nuclear power plant situation, 11:11323 (RA;CS;In Czech)
Reliability of fossil-fuel and nuclear power installations, 11:11243 (R;CS;In Czech, Slovak, German and Russian)
Role of experts in the safety and reliability of nuclear installations. Analysis of situation in the Federal Republic of Germany, 11:11316 (RA;CS;In German)
Utilization of conventional and nuclear power plant reliability information systems, 11:11216 (RA;CS;In Czech)
Risk Assessment
Problems of applying the reliability theory in the nuclear power plant situation, 11:11323 (RA;CS;In Czech)
Risk-based evaluation of technical specifications, 11:11313 (R;US)
Value impact assessment of standard review plan sections, 11:11347 (R;US)
Sabotage
Proposed Revision 1 to Regulatory Guide 5.62: reporting of physical security events. Draft regulatory guide and value/impact statement, 11:11264 (R;US)
Seismic Effects
Reliability evaluation of containments including soil-structure interaction, 11:11332 (R;US)
Summary report on the Seismic Safety Margins Research Program, 11:11338 (R;US)
Soil-Structure Interactions
Reliability evaluation of containments including soil-structure interaction, 11:11332 (R;US)
Specifications
Comparison of methods applicable to evaluation of nuclear power plant technical specifications, 11:11294 (R;US)
Risk-based evaluation of technical specifications, 11:11313 (R;US)
Transients
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
Turbogenerators
Design problems of reliable turbogenerators 2, 11:11271 (RA;CS;In Russian)
Valves
Aging and service wear of check valves used in engineered safety-feature systems of nuclear power plants. Volume 1. Operating experience and failure identification, 11:11273 (R;US)
Reliability of power plant supply pumps and special valves, 11:11272 (RA;CS;In Czech)
Water Chemistry
Progress report 1981-1982. Reactor Chemistry Department, 11:11267 (R;AR;In Spanish)
Water Treatment
Life and reliability of water treatment equipment manufactured by CKD Dukla for fossil-fuel and nuclear power plants, 11:11246 (RA;CS;In Czech)

NUCLEAR POWER STATIONS
See NUCLEAR POWER PLANTS

NUCLEAR REACTION ANALYSIS
Meetings
Proceedings of the third meeting on nuclear analysis, 11:11623 (R;DD;In English, German and Russian)

NUCLEAR REACTIONS
See also HADRON REACTIONS
HEAVY ION FUSION REACTIONS
PHOTONUCLEAR REACTIONS
SPALLATION

Cross Sections
Applied Nuclear Science Research and Development progress report, June 1, 1984-May 31, 1985, 11:12280 (R;US)
Nuclear Data Collections
Bank of data on nuclear inclusive cross-sections at high-energies of projectiles, 11:11925 (R;SU;In Russian)

NUCLEAR REACTORS
See REACTORS

NUCLEAR SAFETY
See RADIATION PROTECTION

NUCLEAR SCREENING
Born-Oppenheimer Approximation
Nuclear-motion corrections to Born-Oppenheimer barrier heights for chemical reactions, 11:11640 (R;US)

NUCLEAR STRUCTURE
Color Model
Multiquark states in nuclei and the deep inelastic scattering, 11:12370 (R;SU)
Lectures
Subnucleon freedom degrees, 11:12358 (R;FR;In French)
Nuclear Data Collections
Coordination of the international network of nuclear structure and decay data evaluators. Summary report of a consultants' meeting organized by the IAEA and held at the Fachinformationszentrum in Karlsruhe, FRG, 3-6 April 1984, 11:12278 (R;XA)
Quark Model
Quarks and nuclear properties, 11:12362 (R;US)
Structure Functions
Multiquark states in nuclei and the deep inelastic scattering, 11:12370 (R;SU)

NUCLEAR WASTE POLICY ACTS
Managing the nation's nuclear waste. Overview: Nuclear Waste Policy Act, 11:11081 (R;US)
Implementation
Implementation status of NWPA requirements and relevant activities of the repository projects, 11:11052 (J;US)

NUCLEAR WASTES
See RADIOACTIVE WASTES

NUCLEAR WEAPON TESTS
See NUCLEAR EXPLOSIONS

NUCLEAR WEAPONS
Ingredients of deterrence. Student paper, 11:11387 (R;US)
Fuses
Calculation of lower confidence bounds on system reliability, 11:11855 (R;US)
Government Policies
Evaluation of alternative nuclear employment policy/technology. Executive summary - strategy, technology, and the threat. Technical report, 1 February-31 December 1982, 11:11853 (R;US)
Reliability
Calculation of lower confidence bounds on system reliability, 11:11855 (R;US)

NUCLEON REACTIONS
See also NEUTRON REACTIONS
PROTON REACTIONS
Bag Model
Dynamics of six-quark systems in the soliton bag model, 11:12361 (R;US)

NUCLEON-ANTINUCLEON INTERACTIONS
See also PROTON-ANTIPROTON INTERACTIONS
Antiproton-nucleon physics at LEAR, 11:12284 (R;FR;In French)
Annihilation
Antinucleon nucleon annihilations into two mesons, 11:12156 (R;FR)
Elastic Scattering
Antinucleon nucleon annihilations into two mesons, 11:12156 (R;FR)
Exotic Resonances
Nucleon-antinucleon resonance spectrum in a potential model, 11:12191 (R;FR)
Spin
Spin dependent NN and N anti N interaction from the Paris potential, 11:12157 (R;FR)

NUCLEON-NUCLEON INTERACTIONS
Bag Model
$^1S_0$ and $^3S_1$ - $^3D_1$ nucleon-nucleon potentials in the quark compound bag model, 11:12198 (R;SU)
Analysis of eigenvalues for the energy dependent potentials and NN interaction in the quark compound bag model, 11:12197 (R;SU)
Nucleon-nucleon forces in the quark compound bag model and few-nucleon systems, 11:12199 (R;SU)
Nucleon-Nucleon Potential
$^1S_0$ and $^3S_1$ - $^3D_1$ nucleon-nucleon potentials in the quark compound bag model, 11:12198 (R;SU)
Analysis of eigenvalues for the energy dependent potentials and NN interaction in the quark compound bag model, 11:12197 (R;SU)
OPE Model
Future prospects in photon and electron physics at Saclay, 11:12357 (R;FR)
Spin
Spin dependent NN and N anti N interaction from the Paris potential, 11:12157 (R;FR)

NUCLEON-NUCLEON POTENTIAL
Spin Orientation
Off-shell properties of the Paris nucleon-nucleon potential and implications for few-body systems, 11:12193 (R;FR)
Two-Body Problem
Off-shell properties of the Paris nucleon-nucleon potential and implications for few-body systems, 11:12193 (R;FR)

NUCLEONS
See also NEUTRONS
PROTONS
Form Factors
Numerical estimate of nucleon form factors up to momentum transfer squared q^2 approx. 200 GeV^2/c^2, 11:12209 (R;AU)

NUCLEOPROTEINS
Adducts
Biochemical studies on the mechanism of benzo(a)pyrene binding to cellular macromolecules. Progress report, 11:12007 (R;US)

O

OAK RIDGE NATIONAL LABORATORY
See ORNL

OAK RIDGE RESEARCH REACTOR
See ORR REACTOR

OAK RIDGE RESERVATION
Geology
Characterization plan for Solid Waste Storage Area 6, 11:11027 (R;US)
Hydrology
Characterization plan for Solid Waste Storage Area 6, 11:11027 (R;US)
Radioactive Waste Storage
Characterization plan for Solid Waste Storage Area 6, 11:11027 (R;US)
Underground Storage
Characterization plan for Solid Waste Storage Area 6, 11:11027 (R;US)

OCCLUSION COMPLEXES
See CLATHRATES

OCEAN THERMAL ENERGY CONVERSION
Research Programs
Hawaii Natural Energy Institute annual report, 1984, 11:11384 (R;US)
Technology Assessment
State of solar energy technology, 11:11404 (RA;PR)

OCEANOGRAPHY
Research Programs
Multidisciplinary oceanography program on the southeastern US continental shelf, 11:11913 (J;US)

OCEANS
See SEAS

OCONEE-1 REACTOR
Oconee, South Carolina, USA
Reactor Cooling Systems
RELAP5 thermal-hydraulic analyses of two pressurized thermal shock sequences for the Oconee-1 pressurized water reactor, 11:11311 (R;US)
Transients
RELAP5 thermal-hydraulic analyses of two pressurized thermal shock sequences for the Oconee-1 pressurized water reactor, 11:11311 (R;US)
OCONEE-3 REACTOR
Oconee, South Carolina, USA
Risk Assessment
Review of the turbine-building flooding study of the Oconee PRA, 11:11291 (R;US)
OCTANE
Piezometry
Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)
OCTANOLS
Solubility
Removal of n-alcohols from an aqueous stream using micellar-enhanced ultrafiltration, 11:11672 (R;US)
Ultrafiltration
Removal of n-alcohols from an aqueous stream using micellar-enhanced ultrafiltration, 11:11672 (R;US)
OCTYL ALCOHOLS
See OCTANOLS
OFFICE BUILDINGS
Energy Conservation
Energy conservation in large buildings, 11:11452 (J;US)
Structure of the plant and results of measurement of energy requirement for the supply of heat and cold to the administration building at Thyssengas in Duisburg, 11:11436 (RA;DE;In German)
Gas Heat Pumps
Structure of the plant and results of measurement of energy requirement for the supply of heat and cold to the administration building at Thyssengas in Duisburg, 11:11436 (RA;DE;In German)
Space HVAC Systems
Energy conservation in large buildings, 11:11452 (J;US)
OFFSHORE DRILLING
Environmental Effects
Oil in the sea: inputs, fates, and effects. Final report, 11:10941 (R;US)
Environmental Impacts
Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 7. Hazards, 11:10951 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 8. Hazards and data management, 11:10952 (R;US)
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 28, 11:10943 (R;US)
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 29, 11:10944 (R;US)
Oil Spills
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1980. Volume 7. Transport data management, 11:10946 (R;US)
Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 6. Transport, 11:10950 (R;US)
Framework for oil-spill response on the Alaskan OCS (Outer Continental Shelf), 11:10940 (R;US)
Water Pollution
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1980. Volume 6. Transport, 11:10945 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 3. Effects of contaminants, 11:10947 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 8. Hazards and data management, 11:10952 (R;US)
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 27, 11:10942 (R;US)
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 28, 11:10943 (R;US)
Outer Continental Shelf environmental assessment program. Final reports of principal investigators. Volume 29, 11:10944 (R;US)
OIL FURNACES
Fouling
Potential of micronized coal-water slurry as an alternate fuel in oil- and gas-fired boilers, 11:10885 (RA;US)
Fuel Substitution
Potential of micronized coal-water slurry as an alternate fuel in oil- and gas-fired boilers, 11:10885 (RA;US)
Performance
Introducing indigenous coal-water-mix fuels to the Philippines: assessment of project feasibility, 11:10892 (RA;US)
Performance Testing
Potential of micronized coal-water slurry as an alternate fuel in oil- and gas-fired boilers, 11:10885 (RA;US)
Retrofitting
Introducing indigenous coal-water-mix fuels to the Philippines: assessment of project feasibility, 11:10892 (RA;US)
OIL SHALE WASTE WATER
See OIL SHALES
WASTE WATER
OIL SHALES
Activation Analysis
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)
In-Situ Retorting
Alkaline and Stretford scrubbing tests for H_2S removal from in-situ oil retort offgas. Final report, February 1983-February 1985, 11:10968 (R;US)
Characterization of a non-uniform retort using tracer techniques, 11:10971 (J;US)
Retorting
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)
Operating experience with the Livermore solid-recycle retort system, 11:10970 (R;US)
Solvent Extraction
Extraction of Green River and Chattanooga oil shales with strong bases and nucleophilic displacement reagents, 11:10967 (R;US)
OIL SPILL FINGERPRINTING
See OIL SPILLS
OIL SPILLS
Detection
Use of airborne microwave radiometry for the detection and investigation of oil slicks at sea, 11:10939 (R;US)
Environmental Effects
Oil in the sea: inputs, fates, and effects. Final report, 11:10941 (R;US)
Environmental Impacts
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 4. Effects of contaminants, 11:10948 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1981. Volume 5. Transport, 11:10949 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1980. Volume 7. Transport data management, 11:10946 (R;US)

Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 6. Transport, 11:10950 (R;US)
Environmental assessment of the Alaskan Continental Shelf. Final reports of principal investigators. Volume 18. Biological studies, 11:10953 (R;US)
Water Pollution
Environmental assessment of the Alaskan Continental Shelf. Annual reports of principal investigators for the year ending March 1980. Volume 7. Transport data management, 11:10946 (R;US)
Environmental assessment of the Alaskan continental shelf. Annual reports of principal investigators for the year ending March 1981. Volume 6. Transport, 11:10950 (R;US)
Water Pollution Control
Framework for oil-spill response on the Alaskan OCS (Outer Continental Shelf), 11:10940 (R;US)

OIL WELLS
In-Situ Combustion
Analysis of the potential for enhanced oil recovery in the Shannon Formation at Naval Petroleum Reserve Number 3. Master's thesis, 11:10930 (R;US)
Microemulsion Flooding
Analysis of the potential for enhanced oil recovery in the Shannon Formation at Naval Petroleum Reserve Number 3. Master's thesis, 11:10930 (R;US)
Pumps
Verti Jack Pumping Unit evaluation, 11:10931 (R;US)
Steam Injection
Analysis of the potential for enhanced oil recovery in the Shannon Formation at Naval Petroleum Reserve Number 3. Master's thesis, 11:10930 (R;US)

OLIGONUCLEOTIDES
Chemical Preparation
[Templates, site specifically modified with carcinogens]. Final report, 11:11947 (R;US)

OLIGOSACCHARIDES
Molecular Models
Hydrogen bonding patterns and dynamics in biological macromolecules, 11:11946 (R;US)

OMEGA FACILITY
LLE Review. Quarterly report, April-June 1985, 11:12488 (R;US)
Apertures
[Experiments on the OMEGA Laser System]. LLE Review. Quarterly report, July-September 1985. Volume 24, 11:12489 (R;US)
Research Programs
[Experiments on the OMEGA Laser System]. LLE Review. Quarterly report, July-September 1985. Volume 24, 11:12489 (R;US)
[Laser energetics quarterly report, January-March 1985]. Volume 22, 11:12430 (R;US)

OPE MODEL
Structure Functions
Structure functions of nuclei in the pion exchange model, 11:12356 (R;US)

OPTICAL MICROSCOPES
Illuminance
Laser-illuminated nano-second microscope, 11:11754 (J;US)

ORGAN CULTURES
See TISSUE CULTURES

ORGANELLES
See ORGANOIDS

ORGANIC BROMINE COMPOUNDS
Crystal Structure
Structure of 3,4;3',4'-bis(ethylenedithio)-2,2',5,5'-tetrathiafulvalent-tetrabromoindate (2:1), (BEDT-TTF)$_2$InBr$_4$, ($C_{10}H_8S_8$)$_2$InBr$_4$, 11:11601 (J;DK)

ORGANIC CHLORINE COMPOUNDS
See also CHLORINATED ALIPHATIC HYDROCARBONS
Photoacoustic Spectroscopy
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)
Piezometry
Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)

ORGANIC COMPOUNDS
See also AMINES
AROMATICS
CARBOHYDRATES
HETEROCYCLIC COMPOUNDS
HYDROCARBONS
KETONES
LIPIDS
ORGANIC NITROGEN COMPOUNDS
ORGANIC OXYGEN COMPOUNDS
ORGANIC PHOSPHORUS COMPOUNDS
ORGANIC SULFUR COMPOUNDS
ORGANOMETALLIC COMPOUNDS
PROTEINS
Extraction
Batch and column extraction procedures for organics in solid wastes, 11:11480 (J;US)
Removal
Research on wastewater treatment and reuse for coal gasification and liquefaction, 11:10738 (RA;US)

ORGANIC IODINE COMPOUNDS
Diagnostic Uses
Structurally modified fatty acids - clinical potential as tracers of metabolism, 11:11972 (R;US)
Metabolism
Structurally modified fatty acids - clinical potential as tracers of metabolism, 11:11972 (R;US)

ORGANIC MATTER
Only for unspecified materials containing chain and ring compounds of carbon; if specific organic compounds are studied, use descriptors for the compounds.
See also PEAT
Yields
Extraction of Green River and Chattanooga oil shales with strong bases and nucleophilic displacement reagents (Organic carbon), 11:10967 (R;US)

ORGANIC NITROGEN COMPOUNDS
Excluding PROTEINS, AMINES, ALKALOIDS, AMINO ACIDS, NUCLEIC ACIDS, and NUCLEOTIDES.
See also AZINES
AZOLES
Adsorption
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
Orientation of CH_3NC adsorbed on Ag(311), 11:11680 (J;US)
Desorption
Orientation of CH_3NC adsorbed on Ag(311), 11:11680 (J;US)
Excited States
Charge-transfer luminescence from mixed-ligand, 2,2',2"-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)
Ion Exchange Chromatography
Determination of nitrogen-sulfur compounds by ion chromatography, 11:11628 (J;US)
Luminescence
Charge-transfer luminescence from mixed-ligand, 2,2',2"-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)
Orientation
Orientation of CH_3NC adsorbed on Ag(311), 11:11680 (J;US)
Pyrolysis
Deuterium isotope effects in condensed-phase thermochemical decomposition reactions of octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, 11:11694 (J;US)
Toxicity
Comparative biology and chemistry of boiling point fractions from different coal liquefaction processes, 11:10927 (R;US)

ORGANIC OXYGEN COMPOUNDS
Excluding HYDROXY COMPOUNDS, CARBONIC ACID DERIVATIVES, LIPIDS, STEROIDS, CARBOHYDRATES, ORGANIC ACIDS, ALDEHYDES, KETONES and ESTERS.
See also EPOXIDES
QUINONES
RHODAMINES
Piezometry
Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)

ORGANIC PHOSPHORUS COMPOUNDS
Excluding NUCLEIC ACIDS and NUCLEOTIDES.
See also UDPG
Chemical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Isomerization
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Physical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
ORGANIC SOLVENTS
Carcinogen Screening
EDS Coal Liquefaction Process Development. Phase V. Quarterly technical progress report, July 1-September 30, 1985, 11:10920 (R;US)
Comparative Evaluations
Enhanced coal liquefaction with ammonia and amines in single and binary solvent systems. Seventh quarterly report, April 1-June 30, 1985, 11:10780 (R;US)
Hydrogen Transfer
Determination of radical initiating and hydrogen donating properties of coal liquefaction process solvents by reaction with fluorenone, 11:10792 (R;US)
Recycling
Determination of radical initiating and hydrogen donating properties of coal liquefaction process solvents by reaction with fluorenone, 11:10792 (R;US)
EDS Coal Liquefaction Process Development. Phase V. Quarterly technical progress report, July 1-September 30, 1985, 11:10920 (R;US)
Liquefaction, 11:10739 (RA;US)
LRC liquefaction reducing gas composition and moisture effects product yield, quality and operability, 11:10740 (RA;US)
Toxicity
EDS Coal Liquefaction Process Development. Phase V. Quarterly technical progress report, July 1-September 30, 1985, 11:10920 (R;US)
ORGANIC SULFUR COMPOUNDS
See also THIONYL CHLORIDES
THIOPHENE
Crystal Structure
Structure of 3,4;3',4'-bis(ethylenedithio)-2,2',5,5'-tetrathiafulvalent-tetrabromoindate (2:1), $(BEDT\text{-}TTF)_2InBr_4$, $(C_{10}H_8S_8)_2InBr_4$, 11:11601 (J;DK)
Ion Exchange Chromatography
Determination of nitrogen-sulfur compounds by ion chromatography, 11:11628 (J;US)
Oxidation
Redox reactivity of transition-metal phthalocyanines: ligand radical formation vs. metal center oxidation, 11:11682 (J;US)
Photochemistry
Photophysical behaviors of N-methylthioacridone triplet and efficiency of singlet oxygen generation from its quenching by oxygen, 11:11707 (J;NL)
ORGANOIDS
Biological Functions
Immunocytochemical and cytochemical evidence for an intracellular role for plant Golgi apparatus, 11:11959 (RA;US)
Chemical Composition
Sterol composition of chitosomes from Mucor rouxii, comparison with whole cells, 11:11942 (RA;US)
ORGANOMETALLIC COMPOUNDS
For compounds of metals and semimetals with organic compounds, but only when the metal or semimetal is directly bound to carbon.
Chemical Preparation
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)$W(CO)_3H$ (R = H, Me): structures of $[CpW(CO)_3]_2(\mu\text{-}S)$ and [Cp/sup */$W(CO)_2$ (μ-S. $SO)_2]_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)
Preparation of $Yb[N(SiMe_3)_2]_2[AiMe_3]_2$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
Synthesis and properties of novel electroactive organometallic polymers. Annual progress report, March 7-December 1, 1985, 11:11673 (R;US)
Chemical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Crystal Structure
Preparation of $Yb[N(SiMe_3)_2]_2[AiMe_3]_2$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
Synthesis and properties of novel electroactive organometallic polymers. Annual progress report, March 7-December 1, 1985, 11:11673 (R;US)
Excited States
Charge-transfer luminescence from mixed-ligand, 2,2',2"-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)
Isomerization
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Luminescence
Charge-transfer luminescence from mixed-ligand, 2,2',2"-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)
Molecular Structure
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)$W(CO)_3H$ (R = H, Me): structures of $[CpW(CO)_3]_2(\mu\text{-}S)$ and [Cp/sup */$W(CO)_2$ (μ-S. $SO)_2]_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Synthesis and properties of novel electroactive organometallic polymers. Annual progress report, March 7-December 1, 1985, 11:11673 (R;US)
Photochemistry
Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)
Photoelectron Spectroscopy
Transition metal-isocyanide bonding: Photoelectron spectroscopic study of iron tetracarbonyl isocyanide complexes, 11:11659 (J;US)
Physical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
ORIFICES
Size
Prediction of flow rates through an orifice at pressures corresponding to the transition between molecular and isentropic flow, 11:11763 (R;US)
ORNL
Radiation Accidents
Investigation report of the release of strontium-90 from the Building 3517 cell ventilation improvements construction site on November 29, 1985, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 11:11082 (R;US)
Radioactive Effluents
Investigation report of the release of strontium-90 from the Building 3517 cell ventilation improvements construction site on November 29, 1985, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 11:11082 (R;US)

Research Programs
Oak Ridge National Laboratory Institutional Plan, FY 1986-FY 1991, 11:12514 (R;US)

ORNL RESEARCH REACTOR
See ORR REACTOR

ORR REACTOR
Fuel Management
Oak Ridge Research Reactor quarterly report July, August, and September 1985, 11:11285 (R;US)
Reactor Maintenance
Oak Ridge Research Reactor quarterly report July, August, and September 1985, 11:11285 (R;US)
Reactor Operation
Oak Ridge Research Reactor quarterly report July, August, and September 1985, 11:11285 (R;US)

OSIRIS REACTOR
In Pile Loops
"OPERA" loop in the OSIRIS reactor core. Pressurized water irradiation device for the study of advanced reactor fuels, 11:11286 (R;FR;In French)
Irradiation Devices
"OPERA" loop in the OSIRIS reactor core. Pressurized water irradiation device for the study of advanced reactor fuels, 11:11286 (R;FR;In French)

OSMIUM CHLORIDES
Chemical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of M(Ph$_2$PCH$_2$PPh$_2$)$_2$Cl$_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Isomerization
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of M(Ph$_2$PCH$_2$PPh$_2$)$_2$Cl$_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Physical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of M(Ph$_2$PCH$_2$PPh$_2$)$_2$Cl$_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)

OSMIUM COMPLEXES
Chemical Preparation
Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)
Excited States
Charge-transfer luminescence from mixed-ligand, 2,2′,2″-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)
Luminescence
Charge-transfer luminescence from mixed-ligand, 2,2′,2″-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)
Photochemistry
Excited state photoelectrochemical production of H_2O_2 and Br_2, 11:11175 (J;GB)
Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)

OTEC
See OCEAN THERMAL ENERGY CONVERSION

OUTER CONTINENTAL SHELF
See CONTINENTAL SHELF

OVERBURDEN
Compression Strength
Geotechnical studies on the overburden rock from the Hanna IV UCG site, 11:10751 (RA;US)
Rock Mechanics
Geotechnical studies on the overburden rock from the Hanna IV UCG site, 11:10751 (RA;US)
Strata Movement
Geotechnical studies on the overburden rock from the Hanna IV UCG site, 11:10751 (RA;US)

OXIRANS
See EPOXIDES

OXONIUM IONS
Infrared Spectra
Calculated νZ (inversion) spectrum of H_3O^+, 11:12097 (J;US)

OXYGEN
Activation Analysis
Activation analysis, 11:11609 (RA;US)
Adsorption
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
Chemical Reactions
Measurement of the $C_3(a^3\Pi_u)$ and $C_2(X^1\Sigma_g^+)$ disappearance rates with O_2 from 298 to 1300 kelvin, 11:11710 (J;US)
Combustion
Determination of flame propagation limits in stoichiometric oxyhydrogen mixtures with steam, 11:11738 (RA;XA)
Theoretical evaluation of critical gas layer thickness in relation to detonation wave propagation, 11:11737 (RA;XA)
Crystal Structure
Infrared spectra and structure of thin films of solid oxygen, 11:11655 (J;US)
Explosions
Theoretical evaluation of critical gas layer thickness in relation to detonation wave propagation, 11:11737 (RA;XA)
Infrared Spectra
Infrared spectra and structure of thin films of solid oxygen, 11:11655 (J;US)
P States
Nonstatistical population of the 1s2p 2^1P_1 and 2^3P_1 states in recoil ions produced by heavy ion impact, 11:12072 (RA;US)
Photoacoustic Spectroscopy
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)
Precipitation
Effects of thermal donor generation and annihilation upon oxygen precipitation, 11:11587 (R;US)
Recombination
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)
X-Ray Spectra
Ion-excited K X-ray spectra of oxygen, 11:12076 (RA;US)

OXYGEN 16 REACTIONS
Alpha-Transfer Reactions
Effects of the dynamic α-transfer polarization potential in the large-angle scattering of $^{16}O+^{28}Si$, 11:12315 (R;BR)
Backscattering
Effects of the dynamic α-transfer polarization potential in the large-angle scattering of $^{16}O+^{28}Si$, 11:12315 (R;BR)
Role of peripheral partial waves in the anomalous large angle scattering of n-α nuclei, 11:12366 (R;BR)
Elastic Scattering
Role of peripheral partial waves in the anomalous large angle scattering of n-α nuclei, 11:12366 (R;BR)
Heavy Ion Fusion Reactions
Study on particle emission in the light-heavy ion fusion reactions: ^{14}N, sup(16,18) O + ^{12}C, 11:12299 (R;BR)
Scattering
Time-dependent Dirac equation with relativistic mean-field dynamics applied to heavy-ion scattering, 11:12306 (J;US)
Spallation
Time-dependent Dirac equation with relativistic mean-field dynamics applied to heavy-ion scattering, 11:12306 (J;US)

OXYGEN 16 TARGET
Muon Reactions
Radiative muon capture on ^{16}O, 11:12303 (R;SU;In Russian)
Oxygen 16 Reactions
Time-dependent Dirac equation with relativistic mean-field dynamics applied to heavy-ion scattering, 11:12306 (J;US)
Proton Reactions
Intermediate energy nucleon-nucleus total reaction cross section in the Dirac phenomenology, 11:12318 (R;BR)

OXYGEN 18 REACTIONS
Heavy Ion Fusion Reactions
Study on particle emission in the light-heavy ion fusion reactions: ^{14}N, sup(16,18) O + ^{12}C, 11:12299 (R;BR)

Many-Nucleon Transfer Reactions
Use of energy-averaged cross sections for nuclear spectroscopy: ^{26}Mg states in the continuum, 11:12313 (R;BR)
OXYGEN EFFECT (RADIOBIOLOGY)
See OXYGEN
OXYGEN HYDRIDES
See WATER
OXYGEN IONS
Ion-Atom Collisions
L-shell X-ray production cross sections in Nd, Gd, Ho, Yb, Au and Pb for 25-MeV carbon and 32-MeV oxygen ions, 11:12110 (J;NL)
M-shell electron capture and direct ionization of gold by 25-MeV carbon and 32-MeV oxygen ions, 11:12111 (J;NL)
X-Ray Spectra
Spectroscopy of Ldagger-series transitions for x-ray laser photopumping, 11:11760 (J;US)
OXYMETHYLENE
See FORMALDEHYDE

P

P REACTOR
Compliance
Compliance of the Savannah River Plant P-Reactor cooling system with environmental regulations. Demonstrations in accordance with Sections 316(a) and (b) of the Federal Water Pollution Control Act of 1972, 11:11922 (R;US)
PACIFIC OCEAN
See also GULF OF ALASKA
Air-Water Interactions
Associations between summer circulation anomalies and sea surface temperature forcing, 11:11863 (R;US)
Statistical look at air-sea interaction in the North Pacific, 11:11908 (R;US)
Climate Models
Low-frequency variability in a climate model with a mixed-layer ocean, 11:11860 (R;US)
PACKAGING
Design
Radioactive waste isolation in salt: peer review of Westinghouse Electric Corporation's report on reference conceptual designs for a repository waste package, 11:10997 (R;US)
Evaluation
Radioactive waste isolation in salt: peer review of Westinghouse Electric Corporation's report on reference conceptual designs for a repository waste package, 11:10997 (R;US)
Review of DOE Waste Package Program. Semiannual report, October 1984-March 1985. Volume 8, 11:11025 (R;US)
Radiation Effects
Effect of alpha and gamma radiation on the near-field chemistry and geochemistry of high-level waste packages, 11:11031 (R;US)
Reliability
How reliable does the waste package containment have to be, 11:11036 (RA;US)
Repair
Renovation of DOT specification 21PF-1 protective shipping packages, 11:11746 (R;US)
Research Programs
Review of DOE Waste Package Program. Semiannual report, October 1984-March 1985. Volume 8, 11:11025 (R;US)
PACKED BED
Analytical Solution
Analytical solution for a first-order reaction in a packed bed with diffusion, 11:11665 (J;US)
PAH
See POLYCYCLIC AROMATIC HYDROCARBONS
PAKS-1 REACTOR
Paks, Tolna, Hungary
Radiation Monitoring
Dose level measurements during startup of the first unit of the PAKS nuclear power plant, 11:11279 (RA;AT)
Reactor Start-Up
Dose level measurements during startup of the first unit of the PAKS nuclear power plant, 11:11279 (RA;AT)
PALLADIUM
Catalytic Effects
FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report, 11:11130 (R;US)
Infrared Spectra
FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report, 11:11130 (R;US)
Photoluminescence
Photoluminescent response of palladium-cadmium sulfide and palladium-graded cadmium sulfoselenide Schottky diodes to molecular hydrogen. Technical report, 11:11571 (R;US)
Solvent Extraction
Behaviour of palladium in the Purex process, 11:10983 (R;FR)
PALO DURO BASIN
Salt Deposits
Origin of fluid inclusion water in bedded salt deposits, Palo Duro Basin, Texas, 11:10998 (R;US)
PANAMA
Solar Energy
Potential applications of solar energy in the Republic of Panama, 11:11179 (RA;PR)
PANTEX PLANT
Maintenance
Maintenance and the upgraded security system, 11:11109 (J;US)
Security
Maintenance and the upgraded security system, 11:11109 (J;US)
PARABANIC ACID
See ORGANIC OXYGEN COMPOUNDS
PARACHUTES
Performance Testing
Experimental study of the performance of clustered parachutes in a low-speed wind tunnel, 11:11741 (R;US)
PARAFFINS
See ALKANES
PARAGENES
See PLASMIDS
PARTICLE DECAY
See also HADRONIC PARTICLE DECAY
Measuring Methods
Determination of the neutron lifetime using e-p coincidence, 11:12162 (R;US)
PARTICLE IDENTIFICATION
Ionization Chambers
Heavy-ion identification using detector telescopes, 11:11839 (BA;US)
PARTICLE SIZE
Aerosol formation from pulverized coal combustion. Quarterly report No. 7, 11:10906 (R;US)
PARTICULATES
Prior to September 1981, this concept was indexed to PARTICLES and AEROSOLS.
Air Pollution Control
Environmental control technology, 11:11219 (RA;US)
Combustion
Fundamentals of coal dust combustion: recommendations for research on explosive limits of coal dust, 11:10897 (RA;US)
Deposition
Fall-out, wash-out, and rain-out from airborne clouds, 11:11877 (BA;US)
Environmental Transport
Trace element geochemistry of the South Atlantic Bight. Progress report, 11:11907 (R;US)
Inhalation
Surrogate experimental models for studying particle deposition in the human respiratory tract, 11:11871 (R;US)
Removal
Hot gas cleanup for pressurized fluidized bed combustion burning low rank coal, 11:10903 (RA;US)

Retention
Surrogate experimental models for studying particle deposition in the human respiratory tract, 11:11871 (R;US)
Uptake
Retention of ingested latex particles in Peyer's patches of germ-free and conventional mice, 11:12010 (J;US)
Washout
Fall-out, wash-out, and rain-out from airborne clouds, 11:11877 (BA;US)

PASSIVE SOLAR HEATING SYSTEMS
Attached Greenhouses
Passive solar greenhouse. Final technical report, 11:11194 (R;US)
Computerized Simulation
Evaluation of five methods of dimensioning passive solar systems, 11:11188 (RA;CH;In French)
Manuals
Handbook on the utilisation of solar energy in buildings, 11:11187 (RA;CH;In German)
Meetings
IEA Solar Task 8: Passive and hybrid use of solar energy, 11:11185 (R;CH;In German and French)
Performance
Performance of the RPI Passive Solar Visitors Information Center Building for 1982, 11:11190 (R;US)
Research Programs
Passive solar heating research, 11:11196 (BA;US)
Simulation
Parametric studies: Direct-gain windows, conservatories and convective systems, 11:11415 (RA;CH;In German)

PBX DEVICES
PBX is essentially the old PDX with a rearrangement of the divertor coils. The resultant plasma is "beam-shaped" with a goal of 10 percent beta. MHD properties will be studied.
Impurities
Some effects of MHD activity on impurity transport in the PBX tokamak, 11:12448 (R;US)
Magnetohydrodynamics
Some effects of MHD activity on impurity transport in the PBX tokamak, 11:12448 (R;US)

PEAT
Combustion
Peat - a viable alternative for energy production, 11:10813 (RA;PR)
Drying
Peat - a viable alternative for energy production, 11:10813 (RA;PR)
Harvesting
Peat - a viable alternative for energy production, 11:10813 (RA;PR)
Resource Assessment
Peat - a viable alternative for energy production, 11:10813 (RA;PR)
Transport
Peat - a viable alternative for energy production, 11:10813 (RA;PR)

PEATLANDS
See WETLANDS

PECTINS
Biological Functions
Pectic fragments of plant cell walls as mediators of stress responses, 11:11934 (RA;US)

PELLET INJECTION
Plasma Diagnostics
m = 1, n = 1 oscillations following the injection of a fuel pellet on the Alcator C tokamak, 11:12492 (R;US)

PELLETS (FUEL)
See FUEL PELLETS

PENNSYLVANIA STATE UNIVERSITY RESEARCH RE
See FSTR REACTOR

PENTANE
Viscosity
Thermophysical properties correlations and pseudocomponent characterization parameter estimation for fossil fluids. First quarterly report (III year), September 1-November 30, 1985, 11:11674 (R;US)

PEOPLES REPUBLIC OF CHINA
See CHINA

PEPTIDE HORMONES
Biological Effects
Influence of α sex factor on the biosynthesis of the cell wall from Saccharomyces cerevisiae, 11:11939 (RA;US)

PERIOSTEUM
See BONE TISSUES

PERMUTIT (INORGANIC)
See INORGANIC ION EXCHANGERS

PERSONNEL
Studies of groups of persons employed in a particular field of endeavor. For studies on individuals in a group see also MAN.
See also PROFESSIONAL PERSONNEL
REACTOR OPERATORS
SECURITY PERSONNEL
Medical Surveillance
Biomechanical and work physiology study in underground mining, excluding low coal. Open file report, 25 January 1980-22 July 1984, 11:12027 (R;US)
Occupational Safety
Human engineering design guidelines for maintainability. Final report, 11:11314 (R;US)
Performance
Maintenance Personnel Performance Simulation (MAPPS) model. Users' Manual, 11:11328 (R;US)
Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)
Reliability
Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)
Training
Instructional skills evaluation in nuclear industry training, 11:11391 (R;US)
Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)

PERSONNEL DOSIMETRY
Recommendations
Extremity monitoring: considerations for use, dosimeter placement, and evaluation, 11:11998 (R;US)
Stochastic Processes
Stochastic lung dose modelling. A joint Austrian-Hungarian project, 11:11993 (RA;AT)
Thermoluminescent Dosemeters
Investigations of a new thermoluminescent bulb dosimeter, 11:11824 (RA;AT)

PERSONNEL FILM DOSIMETRY
See PERSONNEL DOSIMETRY

PERSONNEL MONITORING
The Pajarito Monitor: a high-sensitivity monitoring system for highly enriched uranium, 11:11840 (J;US)
Whole-Body Counting
Some experiences in incidental internal contamination monitoring and dose assessment, 11:11994 (RA;AT)

PESTICIDES
Supercritical Fluid Chromatography
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)

PETROLEUM
Limited to crude oil; see also COAL LIQUIDS, SHALE OIL, etc.
Consumption Rates
Model of the use of coal, gas, and oil (Brookhaven Energy System Optimization Model (BESOM)), 11:11398 (J;GB)
Imports
Model of the use of coal, gas, and oil (Brookhaven Energy System Optimization Model (BESOM)), 11:11398 (J;GB)
Market
Forecasting world oil prices: the evolution of modeling methodologies and summary of recent projections, 11:10932 (J;US)
Monthly Energy Review, September 1985, 11:10933 (R;US)
Weekly Petroleum Status Report. Data for week ended: January 3, 1986, 11:10935 (R;US)

Prices
Forecasting world oil prices: the evolution of modeling methodologies and summary of recent projections, 11:10932 (J;US)
Supply and Demand
Monthly Energy Review, September 1985, 11:10933 (R;US)
Petroleum Supply Monthly, October 1985, 11:10934 (R;US)
PETROLEUM COKE
See PETROLEUM PRODUCTS
PETROLEUM DEPOSITS
See also NAVAL PETROLEUM RESERVE
Leases
Final environmental impact statement: proposed central Gulf of Mexico OCS Lease Sale 104 (April 1986) and proposed western Gulf of Mexico OCS Lease Sale 105 (July 1986), 11:10964 (R;US)
Final environmental impact statement: proposed Norton Basin Lease Sale 100. Volume 1, 11:10938 (R;US)
PETROLEUM PRODUCTS
See also DIESEL FUELS
FUEL OILS
LIQUEFIED PETROLEUM GASES
Distribution
USAWC (United States Army War College) military studies program paper. Petroleum management in support of combat forces. Student essay, 11:11374 (R;US)
Management
USAWC (United States Army War College) military studies program paper. Petroleum management in support of combat forces. Student essay, 11:11374 (R;US)
Packaging
Precautionary labeling of petroleum products in packages - a labeling system, 11:10954 (R;US)
Pricing Regulations
Price controls, price dispersion, and the supply of refined petroleum products, 11:10936 (J;GB)
Regulations
Precautionary labeling of petroleum products in packages - a labeling system, 11:10954 (R;US)
PETROLEUM REFINERIES
Economics
Alcohols and ideas for savings of petroleum crude at local refineries in the Caribbeans, 11:11136 (RA;PR)
PHANTOMS
Depth Dose Distributions
Neutron dose distribution in a water phantom irradiated with 14 MeV neutrons, 11:12391 (RA;AT)
PHASE STABILITY
Pressure Dependence
VPI-3 alkali attack of coal gasifier refractory linings. Progress report No. 4, October 1-December 31, 1985, 11:10779 (R;US)
Temperature Dependence
VPI-3 alkali attack of coal gasifier refractory linings. Progress report No. 4, October 1-December 31, 1985, 11:10779 (R;US)
PHASE TRANSFORMATIONS
See also MELTING
Mathematical Models
Elements of a dialogue between nonlinear models in condensed matter and biophysics, 11:12088 (R;US)
PHENANTHRENE
Line Narrowing
Phosphorescence line narrowing of coronene and phenanthrene adsorbed on cellulose substrates, 11:11689 (J;US)
Phosphorescence
Phosphorescence line narrowing of coronene and phenanthrene adsorbed on cellulose substrates, 11:11689 (J;US)
PHENANTHROLINES
Chemical Preparation
Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)
Photochemistry
Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)
PHENOL
Monitoring
Techniques used in the determination of the areal extent of organic contamination at the US DOE Hoe Creek underground gasification site, 11:10808 (RA;US)
Water Pollution Monitors
Techniques used in the determination of the areal extent of organic contamination at the US DOE Hoe Creek underground gasification site, 11:10808 (RA;US)
PHENOLS
See also CRESOLS
PHENOL
Oxidation
One-electron redox reactions in aqueous solutions of sulfite with hydroquinone and other hydroxyphenols, 11:11683 (J;US)
Supercritical Fluid Chromatography
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)
PHENYL METHYL ETHER
See ANISOLE
PHENYLAMINE
See ANILINE
PHEROMONE
Biological Effects
Regulation of glycoprotein synthesis in yeast by mating pheromones, 11:11926 (RA;US)
PHI-1019 RESONANCES
Particle Production
Search for quark deconfinement: Strangeness production in pp, dd, pα, and αα collisions at $\sqrt{s}$/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)
PHI4-FIELD THEORY
Free Enthalpy
Percolation temperature and the 'instability' of the effective potential, 11:12237 (R;BR)
PHILIPPINES
Coordinated Research Programs
Introducing indigenous coal-water-mix fuels to the Philippines: assessment of project feasibility, 11:10892 (RA;US)
Fuel Substitution
Introducing indigenous coal-water-mix fuels to the Philippines: assessment of project feasibility, 11:10892 (RA;US)
PHOSPHINES
Excited States
Charge-transfer luminescence from mixed-ligand, 2,2',2"-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)
Luminescence
Charge-transfer luminescence from mixed-ligand, 2,2',2"-terpyridine-phosphine, complexes of osmium(II), 11:11176 (J;GB)
PHOSPHITES
See PHOSPHOROUS ACID
PHOSPHOROUS ACID
Piezometry
Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)
PHOSPHORUS 34
Ground States
Ground state mass excesses and low lying levels of the neutron rich nuclei ^{36}P, ^{35}P and ^{34}P, 11:12311 (R;AU)
Mass Defect
Ground state mass excesses and low lying levels of the neutron rich nuclei ^{36}P, ^{35}P and ^{34}P, 11:12311 (R;AU)
PHOSPHORUS 35
Ground States
Ground state mass excesses and low lying levels of the neutron rich nuclei ^{36}P, ^{35}P and ^{34}P, 11:12311 (R;AU)
Mass Defect
Ground state mass excesses and low lying levels of the neutron rich nuclei ^{36}P, ^{35}P and ^{34}P, 11:12311 (R;AU)
PHOSPHORUS 36
Ground States
Ground state mass excesses and low lying levels of the neutron rich nuclei ^{36}P, ^{35}P and ^{34}P, 11:12311 (R;AU)
Mass Defect
Ground state mass excesses and low lying levels of the neutron rich nuclei ^{36}P, ^{35}P and ^{34}P, 11:12311 (R;AU)

PHOSPHORUS ADDITIONS
Metallurgical Effects
30-MeV electron-beam irradiation effects on GaAs(1-x)P(x) LEDS (light emitting diodes). Master's thesis, 11:11572 (R;US)
PHOTOCONDUCTIVE CELLS
Response Functions
Transient and temperature-dependent phenomena in Ge:Be and Ge:Zn far infrared photoconductors, 11:11583 (R;US)
PHOTODIODES
Performance
Application of Si detectors, photo-diodes and G-M counters in exposure rate measurements, 11:11823 (RA;AT)
PHOTODISINTEGRATION
See PHOTONUCLEAR REACTIONS
PHOTOELECTROCHEMICAL CELLS
Excited state photoelectrochemical production of H_3O_2 and Br_2, 11:11175 (J;GB)
PHOTOLYSIS
Atom-Molecule Collisions
Effect of bending potential on calculated product-state distributions for the reaction H + D_2 yields HD + D, 11:12059 (R;US)
Research Programs
Investigations on multiphoton ionization and laser-ion beam photodissociation spectroscopy. Final report, 11:11702 (R;US)
PHOTOMAGNETOELECTRIC EFFECT
See MAGNETIC FIELDS
PHOTOMULTIPLIERS
Specifications
Facility for studying the cross sections of relativistic nuclear fragment strong interactions at the Dubna synchrophasotron, 11:11833 (RA;SU;In Russian)
PHOTON ACTIVATION ANALYSIS
See ACTIVATION ANALYSIS
PHOTONS
PHOTON COLLISIONS
See also PHOTON-ION COLLISIONS
Bremsstrahlung
Comparison of models for the free-free Gaunt factor at low temperatures and frequencies, 11:12384 (R;US)
PHOTON DETECTION (GAMMA)
See GAMMA DETECTION
PHOTON TRANSPORT
Calculation Methods
Determination of gamma-ray peak efficiency, including correction for self-absorption, in cubic samples, 11:12380 (R;AU)
PHOTON-ION COLLISIONS
Investigations on multiphoton ionization and laser-ion beam photodissociation spectroscopy. Final report, 11:11702 (R;US)
PHOTON-PHOTON INTERACTIONS
Compton Effect
Possibility to study electromagnetic properties of neutral pions in experiments with electron-positron colliding beams, 11:12187 (R;SU;In Russian)
PHOTON-PROTON INTERACTIONS
Inclusive Interactions
Study of inclusive K/sub S/^{0}, Λ, and Lambda-bar production in diffractive γp interactions, 11:12165 (J;US)
PHOTONS
Radiation Detectors
Physics with the crystal ball detector, 11:11841 (J;US)
Statistics
To test photon statistics by atomic beam deflection, 11:12083 (R;IT)
PHOTONUCLEAR REACTIONS
Absorption
Measurement of cross sections of total nuclear photon absorption by the ^{12}C and ^{208}Pb nuclei in the Δ(1232) region, 11:12294 (R;FR;In French)
Breakup Reactions
Study of the $^3He(\gamma p)np$ reaction in the region of the resonance Δ(1232), 11:12285 (R;FR;In French)
Multiple Scattering
Future prospects in photon and electron physics at Saclay, 11:12357 (R;FR)
Reviews
Photonuclear physics at intermediate energies, 11:12365 (R;BR;In Portuguese)
Total Cross Sections
Photoneutron cross sections, 11:12334 (R;BR)
PHOTOSYNTHESIS
Biological Pathways
Control of photosynthetic carbon metabolism, 11:11967 (J;US)
Enzyme Activity
Control of photosynthetic carbon metabolism, 11:11967 (J;US)
PHOTOVOLTAIC CONVERSION
Technology Assessment
State of solar energy technology, 11:11404 (RA;PR)
PHTHALOCYANINES
Oxidation
Redox reactivity of transition-metal phthalocyanines: ligand radical formation vs. metal center oxidation, 11:11682 (J;US)
PHYSICAL PROTECTION DEVICES
Design
Supporting the material control and accountancy system with physical protection system features, 11:11093 (J;US)
PHYSICAL RADIATION EFFECTS
Swelling
Cascade-induced fluctuations and the transition from the stable to the critical cavity radius for swelling, 11:11510 (R;US)
PIGE ANALYSIS
See NUCLEAR REACTION ANALYSIS
PROTON REACTIONS
PINS (FUEL)
See FUEL PINS
PION MINUS REACTIONS
Annihilation
Direct photon production from pions and protons at 200 GeV/c, 11:12295 (R;CH)
Elastic Scattering
Hard quark-quark scattering with exclusive reactions, 11:12170 (J;FR)
Particle Production
Correlations of emission frequency of π0 mesons and proton produced in collisions of protons and π^0 mesons with xenon nuclei within the 2-9 GeV energy range and a problem of slow π^0 meson absorption in a target nucleus, 11:12161 (R;SU;In Russian)
Quasi-Free Reactions
Quasi-free scattering of π^+ and π from ^3He and ^4He at energies from 350 to 475 MeV, 11:12293 (BA;NL)
Scattering
Quasi-free scattering of π^+ and π from ^3He and ^4He at energies from 350 to 475 MeV, 11:12293 (BA;NL)
PION MINUS-PROTON INTERACTIONS
Glueballs
Glueballs in π^- p → phi phi n, 11:12178 (R;BR)
Quantum Chromodynamics
Glueballs in π^- p → phi phi n, 11:12178 (R;BR)
PION PLUS REACTIONS
Annihilation
Direct photon production from pions and protons at 200 GeV/c, 11:12295 (R;CH)
Fission
Angular dependence of the sup(6)Li(πsup(+), sup(3)He)sup(3)He reaction, 11:12304 (R;CA)
Quasi-Free Reactions
Quasi-free scattering of π^+ and π from ^3He and ^4He at energies from 350 to 475 MeV, 11:12293 (BA;NL)
Scattering
Quasi-free scattering of π^+ and π from ^3He and ^4He at energies from 350 to 475 MeV, 11:12293 (BA;NL)
PION REACTIONS
See also PION MINUS REACTIONS
PION PLUS REACTIONS
Charge Exchange
Proceedings of the LAMPF workshop on pion double charge exchange, 11:12281 (R;US)

Coupling Constants
Real and virtual pions in nuclei, 11:12287 (R;FR;In French)
Elastic Scattering
Real and virtual pions in nuclei, 11:12287 (R;FR;In French)
Meetings
Proceedings of the LAMFF workshop on pion double charge exchange, 11:12281 (R;US)
Research Programs
Research in experimental nuclear physics. Progress report, 1 April 1985-31 March 1986, 11:12296 (R;US)

PION-EXCHANGE MODEL
See OPE MODEL

PION-PION INTERACTIONS
Scattering Amplitudes
Sum rules and high-energy asymptotics of pion-pion amplitude for large angles, 11:12189 (R;SU;In Russian)
Sum Rules
Sum rules and high-energy asymptotics of pion-pion amplitude for large angles, 11:12189 (R;SU;In Russian)

PIONS
See also PIONS MINUS
PIONS NEUTRAL
PIONS PLUS
Electromagnetic Form Factors
One-loop corrections to pion form factor in QCD in a light-like gauge, 11:12246 (R;SU)
Energy Losses
Stopping and energy deposition of hadrons in target nuclei, 11:12383 (R;SU)
Quantum Chromodynamics
One-loop corrections to pion form factor in QCD in a light-like gauge, 11:12246 (R;SU)

PIONS MINUS
Particle Production
πi and π^- production in the α-nucleus and nucleus-nucleus collisions between 200 and 800 MeV/nucleon, 11:12342 (R;FR;In French)

PIONS NEUTRAL
Leptonic Decay
Rare decays of neutral π and eta, 11:12206 (R;CA)
Pair Production
Possibility to study electromagnetic properties of neutral pions in experiments with electron-positron colliding beams, 11:12187 (R;SU;In Russian)
Particle Production
Correlations of emission frequency of π^0 mesons and proton produced in collisions of protons and π^0 mesons with xenon nuclei within the 2-9 GeV energy range and a problem of slow π^0 meson absorption in a target nucleus, 11:12161 (R;SU;In Russian)

PIONS PLUS
Particle Production
π^+ and π^- production in the α-nucleus and nucleus-nucleus collisions between 200 and 800 MeV/nucleon, 11:12342 (R;FR;In French)

PIPELINE QUALITY GAS
See HIGH BTU GAS

PIPELINES
Fluid Flow
Field test of drag reducing agents in a three-inch pipeline at the West Hackberry, Louisiana SPR site, 11:10957 (R;US)

PIPES
Cracks
Review of the models and mechanisms for environmentally-assisted crack growth of pressure vessel and piping steels in PWR environments, 11:11524 (R;US)
Gas Flow
TOPAZ - the transient one-dimensional pipe flow analyzer: equations and numerics, 11:12132 (R;US)
In-Service Inspection
Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)
Stress Corrosion
BWR pipe crack and weld clad overlay studies, 11:11231 (R;US)
Ultrasonic Testing
Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)

PITTSBURG-MIDWAY SOLVENT REFINED COAL PRO
See SRC PROCESS

PIXE ANALYSIS
Prior to October 1980, this concept was indexed to X-RAY EMISSION ANALYSIS.
Meetings
Proceedings of the third meeting on nuclear analysis, 11:11623 (R;DD;In English, German and Russian)

PLANKTON
See also ZOOPLANKTON
Site Surveys
Upper bay network: a study of the plankton resources of the upper Chesapeake Bay. Volume 1, text. Volume 2, Appendices a-o. Final report 1982-1983, 11:11909 (R;US)

PLANT CELLS
Antigen-Antibody Reactions
Membrane-bound β-lectins: agglutination of protoplasts by multivalent phenyl-β-glucosides, 11:11943 (RA;US)
Biochemistry
Utilization of glucose and UDPG by supprotoplasts of cotton fiber cells, 11:11940 (RA;US)
Cell Differentiation
Control of cell wall assembly during differentiation, 11:11956 (RA;US)
Cytochemistry
Immunocytochemical and cytochemical evidence for an intracellular role for plant Golgi apparatus, 11:11959 (RA;US)
Cytological Techniques
Are cortical microtubules essential for cell formation and cell division by isolated callus protoplasts?, 11:11960 (RA;US)
Immune Reactions
Immunocytochemical and cytochemical evidence for an intracellular role for plant Golgi apparatus, 11:11959 (RA;US)
Scanning Electron Microscopy
Fungal penetration of defensive barriers of plants, 11:11933 (RA;US)
Transmission Electron Microscopy
Fungal penetration of defensive barriers of plants, 11:11933 (RA;US)

PLANT GROWTH
Biochemistry
Regulation of cell wall mechanical properties in vivo and in vitro, 11:11983 (RA;US)

PLANT GROWTH REGULATORS
See also AUXINS
Biochemistry
Could phytoalexin elicitors operate by a crosslinking mechanism?, 11:11944 (RA;US)
Radioimmunoassay
Identification of calmodulin released by osmotic shock of maize roots, 11:11971 (RA;US)

PLANT STEMS
Autoradiography
Macromolecular organization of xyloglucan and cellulose in pea epicotyls, 11:11970 (RA;US)

PLANTS
See also ALGAE
FUNGI
GRASS
TREES
VEGETABLES
Productivity
Bamboo as a renewable energy source, 11:11159 (RA;PR)
Resource Potential
Bamboo as a renewable energy source, 11:11159 (RA;PR)

PLANTS (INDUSTRIAL)
See INDUSTRIAL PLANTS

PLANTS (POWER)
See POWER PLANTS

PLASMA
See also COLLISIONAL PLASMA
COLLISIONLESS PLASMA
EQUILIBRIUM PLASMA
HOT PLASMA
INHOMOGENEOUS PLASMA
LASER-PRODUCED PLASMA

RELATIVISTIC PLASMA
ROTATING PLASMA
Charged-Particle Transport Theory
SCORCH - a zero dimensional plasma evolution and transport code for use in small and large tokamak systems, 11:12425 (R;AU)
Compression
Acceleration of beam ions during major-radius compression in the tokamak fusion test reactor, 11:12464 (J;US)
Electric Fields
Bifurcation phenomena and the radial electric field in a nonaxisymmetric plasma, 11:12461 (J;US)
Fluctuations
Observation of large amplitude, narrow-band density fluctuations in the interior region of an Ohmic tokamak plasma, 11:12465 (J;US)
Flute Instability
Linear studies of resistive interchange modes in a cylindrical reversed field pinch, 11:12463 (J;US)
Heat Flux
Neoclassical transport fluxes in the plateau regime in nonaxisymmetric toroidal plasmas, 11:12460 (J;US)
Impurities
Long-time impurity confinement as a precursor to disruptions in ohmically heated tokamaks, 11:12468 (J;US)
Joule Heating
Long-time impurity confinement as a precursor to disruptions in ohmically heated tokamaks, 11:12468 (J;US)
Lower Hybrid Heating
Inductance effect of runaways on lower-hybrid-current ramping, 11:12466 (J;US)
Magnetic Islands
q = 2 sawteeth and major disruptions in tokamaks, 11:12462 (J;US)
Plasma Disruption
Long-time impurity confinement as a precursor to disruptions in ohmically heated tokamaks, 11:12468 (J;US)
q = 2 sawteeth and major disruptions in tokamaks, 11:12462 (J;US)
Quantitative Chemical Analysis
Mass spectrometry of inductively coupled plasmas, 11:11624 (J;US)
Runaway Electrons
Inductance effect of runaways on lower-hybrid-current ramping, 11:12466 (J;US)
Tearing Instability
q = 2 sawteeth and major disruptions in tokamaks, 11:12462 (J;US)

PLASMA ACCELERATORS
See PLASMA GUNS

PLASMA DIAGNOSTICS
Accelerators
Accelerator-based diagnostics in tandem-mirror fusion experiments, 11:12471 (J;NL)
Emission Spectroscopy
Multichordal charge exchange recombination spectroscopy on the Doublet III tokamak, 11:12459 (J;US)
Optical Spectrometers
Multichordal charge exchange recombination spectroscopy on the Doublet III tokamak, 11:12459 (J;US)
Probes
Characteristics of short distance field of a source radiating at electronic frequencies in a ionospheric plasma. Applications to density and electron temperature measurement by mutual impedance probe, 11:12056 (R;FR;In French)

PLASMA DRIFT
Plasma Simulation
Renormalized turbulence theory of ion pressure gradient driven drift modes, 11:12432 (R;US)

PLASMA GUNS
Beam Extraction
Magnetic-field extraction and filamentation of high-current electron beams, 11:12094 (J;US)

PLASMA HEATING
Ion Beam Injection
Acceleration of beam ions during major-radius compression in the tokamak fusion test reactor, 11:12464 (J;US)

PLASMA INSTABILITY
Electromagnetic Radiation
Electromagnetic instabilities and gyrophase-bunched particles, 11:12057 (J;US)
Feedback
Feedback control of resistive instabilities, 11:12449 (R;US)
Quasilinear Problems
Feedback control of resistive instabilities, 11:12449 (R;US)

PLASMA (QUARK)
See QUARK MATTER

PLASMA SHEET
Ion Wave Instability
Observations of the right-hand resonant ion beam instability in the distant plasma sheet boundary layer, 11:12058 (J;US)

PLASMA SIMULATION
Equilibrium fluctuation energy of gyrokinetic plasma, 11:12451 (R;US)
Plasma physics modeling and the Cray-2 multiprocessor, 11:12457 (R;US)
Symmetry Breaking
Spontaneous symmetry breaking and neutral stability in the noncanonical Hamiltonian formalism, 11:12434 (R;US)

PLASMIDS
Light Scattering
Circular intensity differential scattering of light by hierarchical molecular structures, 11:11948 (J;US)

PLASTIC SCINTILLATION COUNTERS
See PLASTIC SCINTILLATION DETECTORS

PLASTIC SCINTILLATION DETECTORS
Performance
Parity violation in ^{3}H (vector p/sub e/, p) H scattering, 11:11820 (RA;US)

PLATINUM
Electrochemistry
Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)
Reduction
Metal-support effects on H_2 and CO heats of adsorption on TiO_2-supported platinum, 11:11654 (J;US)
Sorptive Properties
Laser studies of chemical dynamics at the gas-solid interface. Progress report, 11:11511 (R;US)
Metal-support effects on H_2 and CO heats of adsorption on TiO_2-supported platinum, 11:11654 (J;US)
Structure and reactions of C_2H_4 adsorbed on small Pt clusters, 11:11684 (J;US)
Surface-suppressed electron resonance spectroscopies, 11:11650 (J;US)
Stability
Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)
Surface Properties
Observation of isolated carbon atoms and the study of their mobility on Pt clusters by NMR, 11:11534 (J;US)

PLATYHELMINTHS
Immunity
Murine immunization by cesium-137 irradiation attenuated Schistosoma mansoni cercariae, 11:11992 (R;US)

PLESIOTHERAPY
See RADIOTHERAPY

PLUMES
Diffusion
Atlantic Coast Unique Regional Atmospheric Tracer Experiment (ACURATE), 11:11864 (R;US)
Behavior of stack effluents, 11:11876 (BA;US)
Design and analysis of Cross-Appalachian Tracer Experiment (CAPTEX) field trials. Second annual progress report, 11:11857 (R;US)

PLUTONIUM
Calorimetry
Measurement control assessment of radiometric calorimeters using nonstandards based indicators, 11:11096 (J;US)
Environamental Exposure Pathway
Radiological consequences of brine release by human intrusion into WIPP, 11:11923 (R;US)

Extraction Chromatography
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinide elements, 11:11613 (RA;XA)
Isotope Ratio
Characterization of high-fired PuO_2 as a certified reference material, 11:11097 (J;US)
Comparison of different methods of determining plutonium content and isotopic composition, 11:11622 (R;US)
Mass Spectroscopy
ISPO Task A-126: application of mixed internal standards to the mass spectrometric analysis of plutonium and uranium in spent fuel dissolver solutions: ORNL results, 11:11721 (R;US)
Nuclear Materials Diversion
The Pajarito Monitor: a high-sensitivity monitoring system for highly enriched uranium, 11:11840 (J;US)
Nuclear Materials Management
Measurement control assessment of radiometric calorimeters using nonstandards based indicators, 11:11096 (J;US)
Qualitative Chemical Analysis
Analysis of special recovery samples by Pu(III) spectrophotometry, 11:11611 (R;US)
Radionuclide Migration
Radiological consequences of brine release by human intrusion into WIPP, 11:11923 (R;US)
Reduction
Assessment of photochemical applications to specific stages in Savannah River Plant actinide reprocessing streams, 11:10988 (R;US)

PLUTONIUM 238
Gamma Spectroscopy
Comparison of different methods of determining plutonium content and isotopic composition, 11:11622 (R;US)
Spectrophotometry
Analysis of special recovery samples by Pu(III) spectrophotometry, 11:11611 (R;US)

PLUTONIUM 239
Delayed Neutron Analysis
Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel, 11:11108 (J;US)
Dosimetry
Factors affecting the assessment of lung depositions of transuranics, 11:12000 (R;US)
Gamma Spectroscopy
Comparison of different methods of determining plutonium content and isotopic composition, 11:11622 (R;US)
Nuclear Materials Management
Automatic material identifier, 11:11101 (J;US)
Soil Chemistry
Ground disposal of radioactive wastes at the Hanford site, 11:11901 (R;US)

PLUTONIUM 240
Delayed Neutron Analysis
Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel, 11:11108 (J;US)
Gamma Spectroscopy
Comparison of different methods of determining plutonium content and isotopic composition, 11:11622 (R;US)

PLUTONIUM 240 TARGET
Neutron Reactions
Effect of the choice of scattering data, bound or unbound, and the energy group structure on the calculated absorptions in the 1 eV Pu-240 resonance, 11:12347 (R;CA)

PLUTONIUM 241
Gamma Spectroscopy
Comparison of different methods of determining plutonium content and isotopic composition, 11:11622 (R;US)

PLUTONIUM 242
Gamma Spectroscopy
Comparison of different methods of determining plutonium content and isotopic composition, 11:11622 (R;US)
Isotope Ratio
Evaluation of uranium and plutonium internal standards, 11:11619 (R;US)
ISPO Task A-126: application of mixed internal standards to the mass spectrometric analysis of plutonium and uranium in spent fuel dissolver solutions: ORNL results, 11:11721 (R;US)

PLUTONIUM 244
Isotope Ratio
Evaluation of uranium and plutonium internal standards, 11:11619 (R;US)
ISPO Task A-126: application of mixed internal standards to the mass spectrometric analysis of plutonium and uranium in spent fuel dissolver solutions: ORNL results, 11:11721 (R;US)

PLUTONIUM DIOXIDE
Calibration Standards
Characterization of high-fired PuO_2 as a certified reference material, 11:11097 (J;US)
Calorimetry
Demonstration of the calorimetric assay of large mass, high burn-up PuO_2 samples, 11:11107 (J;US)
Isotope Ratio
Demonstration of the calorimetric assay of large mass, high burn-up PuO_2 samples, 11:11107 (J;US)
Sampling
Demonstration of the calorimetric assay of large mass, high burn-up PuO_2 samples, 11:11107 (J;US)

PNA
See POLYCYCLIC AROMATIC HYDROCARBONS

PNEUMATIC TRANSPORT
Test Facilities
Pneumatic transport of coal in a variable inclined test loop. Quarterly report 2, 11:10858 (R;US)

POISSON EQUATION
Computer Codes
FORTRAN program (RELAX3D) to solve the 3 dimensional Poisson (Laplace) equation, 11:12409 (R;CA)
Equations of Motion
Generalized Euler's formula from Poisson's summation formula and some applications, 11:12412 (R;BR)

POLAR REGIONS
Plasma Drift
Behavior of ionized plasma in the high latitude topside ionosphere. Memorandum report, 11:12054 (R;US)

POLARIMETERS
Calibration
Design and calibration of an X-ray polarimeter, 11:11815 (RA;US)
Design
Design and calibration of an X-ray polarimeter, 11:11815 (RA;US)

POLARIZED BEAMS
Depolarization
Suppresion of beam-beam depolarization, 11:11812 (R;FR)

POLLUTANTS
Not for radioactive contaminants for which use RADIOACTIVE WASTES or other related terminology.
Biogeochemistry
Anaerobic biogeochemical processes in the subsurface. Subsurface transport program, interactive seminar series, 11:11894 (R;US)
Chemical Analysis
Analysis of extractable priority pollutants in water by gas chromatography/mass spectroscopy, 11:11915 (R;US)
Environmental Transport
Multiphase approach to the modeling of porous media contamination by organic compounds. I. Equation development, 11:11897 (J;US)

POLLUTION CONTROL
Use this term for items that involve the removal or management of pollutants after they are formed by a source.
Meetings
Preparation, handling, and storage, 11:10851 (RA;US)
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)
Research Programs
Proceedings of the low-rank coal technology development workshop, 11:10735 (R;US)

POLONIUM 218
Atmospheric Chemistry
Study of the atmospheric chemistry of /sup 218/Po. Final report, August 21, 1983-December 31, 1985, 11:11882 (R;US)
POLYATOMIC MOLECULES
Chiral Symmetry
Circular intensity differential scattering of light by hierarchical molecular structures, 11:11948 (J;US)
Light Scattering
Circular intensity differential scattering of light by hierarchical molecular structures, 11:11948 (J;US)
POLYCYCLIC AROMATIC AMINES
Liquid Column Chromatography
Methodologies for the separation of chemical classes from coal liquefaction materials, 11:10928 (R;US)
POLYCYCLIC AROMATIC HYDROCARBONS
Adsorption
Standardization of alumina and silica adsorbents used for chemical class separations of polycyclic aromatic compounds, 11:11632 (J;US)
Biological Pathways
Metabolic activation pathways of cyclopenta-fused PAH (polycyclic aromatic hydrocarbons) and their relationship to genetic and carcinogenic activity, 11:11870 (R;US)
Carcinogen Screening
Methodologies for the separation of chemical classes from coal liquefaction materials, 11:10928 (R;US)
Gas Chromatography
Methodologies for the separation of chemical classes from coal liquefaction materials, 11:10928 (R;US)
Liquid Column Chromatography
Methodologies for the separation of chemical classes from coal liquefaction materials, 11:10928 (R;US)
Standardization of alumina and silica adsorbents used for chemical class separations of polycyclic aromatic compounds, 11:11632 (J;US)
Mass Spectroscopy
Methodologies for the separation of chemical classes from coal liquefaction materials, 11:10928 (R;US)
Metabolism
Metabolic activation pathways of cyclopenta-fused PAH (polycyclic aromatic hydrocarbons) and their relationship to genetic and carcinogenic activity, 11:11870 (R;US)
Supercritical Fluid Chromatography
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)
Toxicity
Comparative biology and chemistry of boiling point fractions from different coal liquefaction processes, 11:10927 (R;US)
POLYETHERS
See POLYETHYLENE GLYCOLS
POLYETHYLENE GLYCOLS
Electrochemistry
Ultra high vacuum electrochemistry with conducting polymers, 11:11701 (J;GB)
POLYETHYLENE OXIDES
See POLYETHYLENE GLYCOLS
POLY(ISOBUTYLENE OXIDE)
See EPOXIDES
POLYMERS
Crystal Doping
Dependence of radical anion stability on crystal structure, 11:11570 (J;GB)
Excitation
Electric field assisted dissociation of charge transfer states as a mechanism of photocarrier production, 11:11708 (J;US)
Photochemistry
Electric field assisted dissociation of charge transfer states as a mechanism of photocarrier production, 11:11708 (J;US)
POLYNUCLEAR AROMATIC HYDROCARBONS
See POLYCYCLIC AROMATIC HYDROCARBONS
POLYSACCHARIDES
See also CELLULOSE
DEXTRIN
HEMICELLULOSE
MUCOPOLYSACCHARIDES
PECTINS
STARCH
Acid Hydrolysis
KDO (3-deoxy-manno-octulosonic acid), a glycosyl residue thought to occur only in enterobacterial polysaccharides, is also a component of the cell wall of higher plants, 11:11945 (RA;US)
Biochemistry
KDO (3-deoxy-manno-octulosonic acid), a glycosyl residue thought to occur only in enterobacterial polysaccharides, is also a component of the cell wall of higher plants, 11:11945 (RA;US)
Biosynthesis
Noncellulosic β-glucans in cell walls, 11:11952 (RA;US)
Regulatory mechanisms for the synthesis of β-glucans in plants, 11:11927 (RA;US)
Depolymerization
Depolymerization of matrix polysaccharides by endogenous wall enzymes, 11:11929 (RA;US)
Tissue Distribution
Macromolecular organization of xyloglucan and cellulose in pea epicotyls, 11:11970 (RA;US)
POLYSULFIDES
See SULFIDES
POLYTHIONATES
See SULFUR COMPOUNDS
POLYTHIONIC ACIDS
See SULFUR COMPOUNDS
POLY(VINYLIDENE FLUORIDE)
See FLUORINATED ALIPHATIC HYDROCARBONS
POMERANCHUK PARTICLES
Particle Interactions
Ideas on the pomeron-proton interaction at the parton level, 11:12182 (R;CH)
POMERONS
See POMERANCHUK PARTICLES
PONDS
See also SOLAR PONDS
Design
Development of design criteria for waste stabilization ponds in the Western Pacific Islands, 11:11481 (RA;PR)
Performance Testing
Development of design criteria for waste stabilization ponds in the Western Pacific Islands, 11:11481 (RA;PR)
POOLS
See PONDS
POOR PEOPLE
See LOW INCOME GROUPS
PORK
See MEAT
POROUS MATERIALS
Deformation
NEPTUNE: a finite element code for creeping flow of saturated cohesive porous media (Version 1.0), 11:12035 (R;US)
Heat Transfer
Effective heat transfer in the Strategic Petroleum Reserve porous media, 11:10956 (R;US)
PORTSMOUTH CENTRIFUGE ENRICHMENT PLANT
Radiation Monitoring
Aerial radiological survey of the Portsmouth Uranium Enrichment Plant and surrounding area, Portsmouth, Ohio. Date of survey: May 1984, 11:11900 (R;US)
PORTSMOUTH GASEOUS DIFFUSION PLANT
Radiation Monitoring
Aerial radiological survey of the Portsmouth Uranium Enrichment Plant and surrounding area, Portsmouth, Ohio. Date of survey: May 1984, 11:11900 (R;US)
PORTSMOUTH PLANT
See PORTSMOUTH CENTRIFUGE ENRICHMENT PLANT
PORTSMOUTH GASEOUS DIFFUSION PLANT
POSITION SENSITIVE DETECTORS
Design
Performance of a grazing incidence spectrometer system employing a position sensitive microchannel plate detector for beam-foil measurements, 11:11816 (RA;US)

Microchannel Electron Multipliers
Performance of a grazing incidence spectrometer system employing a position sensitive microchannel plate detector for beam-foil measurements, 11:11816 (RA;US)
Performance
Performance of a grazing incidence spectrometer system employing a position sensitive microchannel plate detector for beam-foil measurements, 11:11816 (RA;US)

POSITIVE IONS
See CATIONS

POSITRON BEAMS
Beam Production
Description of the intense, low energy, monoenergetic positron beam at Brookhaven, 11:11114 (R;US)

POSITRON SOURCES
Moderators
Description of the intense, low energy, monoenergetic positron beam at Brookhaven, 11:11114 (R;US)

POSITRONS
Affinity
Theoretical study of the binding of positrons of gaseous molecules, 11:12061 (R;US)

POTABLE WATER
See DRINKING WATER

POTASSIUM
Activation Analysis
Study and application of ion chromatography and activation analysis without chemical separation for the determination of sodium and potassium in muscle tissues, 11:11615 (R;BR;In Portuguese)
Boiling Points
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Critical Pressure
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Critical Temperature
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Desorption
Silicon (111) and (100) surfaces and their interactions with Sc, K, Na and Li; phase changes and kinetics of desorption studied by surface ionization, 11:11667 (J;NL)
Ion Exchange Chromatography
Study and application of ion chromatography and activation analysis without chemical separation for the determination of sodium and potassium in muscle tissues, 11:11615 (R;BR;In Portuguese)
Melting Points
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
X-Ray Spectra
Systematics of K X-ray satellite structure excited by heavy-ion impact, 11:12075 (RA;US)

POTASSIUM 40
Radiation Monitoring
Radioactive substances in building materials. A compilation of results from samples examined at SSI, 11:12392 (R;SE;In Swedish)

POTASSIUM CARBONATES
Catalytic Effects
Catalytic Coal Gasification Process Development Unit operation, 11:10737 (RA;US)
Recovery
Catalytic Coal Gasification Process Development Unit operation, 11:10737 (RA;US)

POTASSIUM COMPOUNDS
See also POTASSIUM CARBONATES
POTASSIUM HYDROXIDES
Ion Channeling
Ion channeling studies of $KTaO_3$:Nb, 11:11562 (J;GB)

POTASSIUM HYDROXIDES
Microwave Spectra
Molten carbonates: microwave studies of the vapor state. Final report, 11:11406 (R;US)
Vapors
Molten carbonates: microwave studies of the vapor state. Final report, 11:11406 (R;US)

POWDERS
Chemical Preparation
Synthesis of submicron titanium diboride powders, 11:11658 (J;US)
Neutron Diffraction
Fourier-filtering techniques for the analysis of high-resolution pulsed neutron powder diffraction data, 11:11557 (R;US)

POWER DEMAND
Forecasting
1985 Annual data summary report for the regional reliability councils of NERC, 11:11402 (R;US)
NERC summary load forecasts: a retrospective appraisal and technical analysis. Final report, 11:11400 (R;US)

POWER DISTRIBUTION SYSTEMS
Automation
Athens automation and control experiment project review meeting, Dallas, Texas, December 5-6, 1984, 11:11223 (R;US)
Control
Athens automation and control experiment project review meeting, Dallas, Texas, December 5-6, 1984, 11:11223 (R;US)
Electrical Faults
The application of synchronous clocks for power system fault location, control and protection, 11:11224 (BA;US)
Failure Mode Analysis
The application of synchronous clocks for power system fault location, control and protection, 11:11224 (BA;US)

POWER GENERATION
See also COGENERATION
Cost
Panama coal to methanol project. Phase I. Feasibility Study. Technical progress report, 11:11140 (R;US)

POWER PLANTS
See also DUAL-PURPOSE POWER PLANTS
FUEL CELL POWER PLANTS
Design
Description and status of the Byrne Creek power project, 11:10746 (RA;US)
Economic Analysis
Description and status of the Byrne Creek power project, 11:10746 (RA;US)
Steam Condensers
Seminar proceedings: prevention of condenser failures - the state of the art, 11:11215 (R;US)

POWER POOLS
See INTERCONNECTED POWER SYSTEMS

POWER SUPPLIES
See also MARX GENERATORS
SPACECRAFT POWER SUPPLIES
Performance
Main magnet power supply, 11:11797 (RA;US)

POWER SYSTEMS
Includes electric power networks with associated generating and transmission facilities.
See also INTERCONNECTED POWER SYSTEMS
Failures
Requirements for designing large district heating systems with respect to operating reliability, 11:11319 (RA;CS;In Czech)
Fault Tree Analysis
Requirements for designing large district heating systems with respect to operating reliability, 11:11319 (RA;CS;In Czech)
Reliability
Review of bulk power system reliability in North America. 1985 Reliability review, 11:11403 (R;US)

POWER TRANSMISSION LINES
Electromagnetic Pulses
Study to simulate high altitude EMP surges induced in overhead power lines. Final report, 11:11856 (R;US)

PP CHAIN
See HYDROGEN BURNING

PREFABRICATED BUILDINGS
Energy Efficiency
Affordable manufactured housing through energy conservation. A guide to designing and constructing energy efficient manufactured homes, 11:11443 (R;US)

PRENATAL IRRADIATION
Genetic Radiation Effects
Chromosome investigations on persons whose mothers have been treated with ionizing radiations during pregnancy, 11:11995 (R;DE;In German)
PRESSURE GROUPS
See INTEREST GROUPS
PRESSURE VESSELS
Cracks
Review of the models and mechanisms for environmentally-assisted crack growth of pressure vessel and piping steels in PWR environments, 11:11524 (R;US)
Fracture Mechanics
ORVIRT.PC: a 2-D finite-element fracture analysis program for a microcomputer, 11:11236 (R;US)
In-Service Inspection
Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)
Stress Analysis
ORVIRT.PC: a 2-D finite-element fracture analysis program for a microcomputer, 11:11236 (R;US)
Thermal Shock
ORVIRT.PC: a 2-D finite-element fracture analysis program for a microcomputer, 11:11236 (R;US)
Ultrasonic Testing
Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)
PRESSURIZED WATER COOLED MODERATED REACTO
See PWR TYPE REACTORS
PRESSURIZED WATER REACTORS
See PWR TYPE REACTORS
PRICE-ANDERSON ACT
Insurance-indemnity coverage for nuclear transportation: an overview, 11:11083 (R;US)
PRICING REGULATIONS
Economic Impact
Price controls, price dispersion, and the supply of refined petroleum products, 11:10936 (J;GB)
PRIMARY COOLANT CIRCUITS
Heat Transfer
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
Modeling of reflux condensation and countercurrent annular flow in a two-phase closed thermosyphon, 11:11312 (R;US)
Hydraulics
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
Modeling of reflux condensation and countercurrent annular flow in a two-phase closed thermosyphon, 11:11312 (R;US)
PRINTED CIRCUITS
Computer-Aided Design
Computer aided design, 11:11801 (RA;US)
PRODUCTION (HYDROGEN)
See HYDROGEN PRODUCTION
PROFESSIONAL PERSONNEL
Training
Nuclear Studies Training Program. Final report, 11:12513 (R;US)
PROGRAM MANAGEMENT
Manuals
Program Management System manual, 11:11008 (R;US)
PROJECT MANAGEMENT
See PROGRAM MANAGEMENT
PROJECTION SPARK CHAMBERS
Design
Proton decay and solar neutrino experiment with a liquid argon Time Projection Chamber, 11:11845 (J;US)
PROMAZINE
See TRANQUILIZERS
PROPANE
Photoacoustic Spectroscopy
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)
Viscosity
Thermophysical properties correlations and pseudocomponent characterization parameter estimation for fossil fluids. First quarterly report (III year), September 1-November 30, 1985, 11:11674 (R;US)
1-PROPANOL
See PROPANOLS
2-PROPANOL
See PROPANOLS
PROPANOLS
Phase Diagrams
Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)
Thermodynamic Activity
Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)
PROPELLANTS
Combustion
Measurements of distributed combustion. Annual report, March 1983-June 1984, 11:11781 (R;US)
Ignition
Criteria for ignition in monopropellant engines, 11:11780 (R;US)
PROPENE
See PROPYLENE
PROPERTIES (CHEMICAL)
See CHEMICAL PROPERTIES
PROPERTIES (MECHANICAL)
See MECHANICAL PROPERTIES
PROPPING AGENTS
Flow Models
Stimulation model for lenticular sands: Proppant transport model. Phase I annual report. Final report, 11:10965 (R;US)
Transport
Stimulation model for lenticular sands: Proppant transport model. Phase I annual report. Final report, 11:10965 (R;US)
PROPULSION SYSTEMS
Gas Turbine Engines
Small-turbine technology review. Final report, February-December 1984, 11:11457 (R;US)
PROPYL ALCOHOLS
See PROPANOLS
PROPYLENE
Chemical Reactions
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)
Photoacoustic Spectroscopy
Trace detection based on chemical amplification of the optoacoustic effect, 11:11633 (J;US)
PROTECTION (RADIATION)
See RADIATION PROTECTION
PROTECTIVE COATINGS
Chemical Composition
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1985, 11:10790 (R;US)
Hardness
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1985, 11:10790 (R;US)
Thickness
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1985, 11:10790 (R;US)
PROTEINS
See also GLUCOPROTEINS
HISTONES
NUCLEOPROTEINS
Biochemistry
Cell wall proteins extracted from suspension-cultured cells, 11:11931 (RA;US)
Chemical Preparation
Cell wall proteins extracted from suspension-cultured cells, 11:11931 (RA;US)
Photosynthesis
Determination of the amount and the type of quinones present in single crystals from reaction center protein from the photosynthetic bacterium Rhodopseudomonas viridis, 11:11705 (J;NL)

Production
Studies of marine macroalgae: saline desert water cultivation and effects of environmental stress on proximate composition. Final subcontract report (Gracilaria tikvahiae; Ulva lactuca), 11:11170 (R;US)

PROTEUS
Delayed Radiation Effects
Recovery of aerobic and anaerobic bacteria from irradiated mice, 11:11990 (R;US)

PROTON REACTIONS
Annihilation
Direct photon production from pions and protons at 200 GeV/c, 11:12295 (R;CH)
Breakup Reactions
Structure of the $^3H \rightarrow n + d(d^*)$ vertexes, 11:12292 (BA;NL)
Capture
Polarized proton induced pion production on ^{10}B at 200, 225, 250 and 260 MeV incident energies, 11:12305 (R;CA)
Charge-Exchange Reactions
Inclusive measurement of (p,πsup(-)xn) double charge exchange reactions on bismuth from threshold to 800 MeV, 11:12344 (R;CA)
Studies of nuclear structure via polarization transfer experiments, 11:12282 (R;US)
sup(10,11) B(p, n) sup(10,11) C reaction between E sub(p) = 13.6 and 14.7 MeV, 11:12298 (R;BR)
Elastic Scattering
Near/far decomposition of the proton-nucleus and antiproton-nucleus elastic scattering angular distributions, 11:12320 (R;BR)
Inelastic Scattering
Studies of nuclear structure via polarization transfer experiments, 11:12282 (R;US)
Multiple Production
Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)
P Invariance
Parity violation in ^2H (vector p/sub e/, p) H scattering, 11:11820 (RA;US)
Pair Production
Study of hadron-hadron collisions at high E/sub T/ and/or high mass di-muon production in open geometry at 800 GeV/c, 11:12151 (RA;US)
Particle Production
Correlations of emission frequency of π^0 mesons and proton produced in collisions of protons and π^0 mesons with xenon nuclei within the 2-9 GeV energy range and a problem of slow π^0 meson absorption in a target nucleus, 11:12161 (R;SU;In Russian)
D/sub phi/ experiment at TeV I, 11:12153 (RA;US)
Search for quark deconfinement: Strangeness production in pp, dd, pα, and $\alpha\alpha$ collisions at $\sqrt{s}$/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)
Research Programs
Triangle Universities Nuclear Laboratory annual report - TUNL XXIV, 1 July 1984-31 August 1985, 11:12275 (R;US)
Scattering
Intermediate energy nucleon-nucleus total reaction cross section in the Dirac phenomenology, 11:12318 (R;BR)
Reactive content of the proton-nucleus impulse - approximation Dirac optical potential, 11:12319 (R;BR)
Spallation
Experimental nuclear and radiochemistry. Progress report and review, 1984, 11:12277 (R;US)
Vertex Functions
Structure of the $^3H \rightarrow n + d(d^*)$ vertexes, 11:12292 (BA;NL)

PROTON-ANTIPROTON INTERACTIONS
Annihilation
Exclusive decays of heavy mesons into baryons, 11:12215 (J;NL)
Status and future of the experiment PS 170 (anti $pp \rightarrow e^+e^-$), 11:12142 (R;FR)
Form Factors
Numerical estimate of nucleon form factors up to momentum transfer squared q^2 approx. 200 GeV^2/c^2, 11:12209 (R;AU)
Particle Production
Production and decay of quark-gluon strings: inclusive distributions of hadrons in psub(tr) and x, 11:12202 (R;SU)

PROTON-DEUTERON INTERACTIONS
Scattering
Parity violation in p-p and p-nucleus scattering at LAMPF, 11:12152 (RA;US)

PROTON-INDUCED X-RAY EMISSION ANALYSIS
See PIXE ANALYSIS

PROTON-PROTON CYCLE
See HYDROGEN BURNING

PROTON-PROTON INTERACTIONS
Particle Production
Search for quark deconfinement: Strangeness production in pp, dd, pα, and $\alpha\alpha$ collisions at $\sqrt{s}$/sub N/N = 31.5 and 44 GeV, 11:12167 (J;US)
Scattering
Parity violation in p-p and p-nucleus scattering at LAMPF, 11:12152 (RA;US)
Spin Orientation
Polarization observables Dsub(NN), P and A for p(pol)p $\rightarrow$ p(pol)π^+n at 800 MeV, 11:12171 (BA;NL)

PROTONS
Electromagnetic Form Factors
Status and future of the experiment PS 170 (anti $pp \rightarrow e^+e^-$), 11:12142 (R;FR)
Energy Losses
Stopping and energy deposition of hadrons in target nuclei, 11:12383 (R;SU)

PROTOPLASTS
See PLANT CELLS

PSR REACTOR
See PSTR REACTOR

PSTR REACTOR
Reactor Operation
Pennsylvania State University Breazeale Nuclear Reactor. Thirtieth annual progress report, July 1, 1984-June 30, 1985, 11:11281 (R;US)

PUBLIC BUILDINGS
See also SHOPPING CENTERS
Daylighting
RPI visitors center, 11:11191 (R;US)
Passive Solar Cooling Systems
DOE passive solar commerical buildings program. Final technical report, 11:11192 (R;US)
Report summarizing the results of constructing a passive solar building for the campus of Rensselaer Polytechnic Institute, Troy, New York, 11:11193 (R;US)
RPI visitors center, 11:11191 (R;US)
Passive Solar Heating Systems
DOE passive solar commerical buildings program. Final technical report, 11:11192 (R;US)
Report summarizing the results of constructing a passive solar building for the campus of Rensselaer Polytechnic Institute, Troy, New York, 11:11193 (R;US)
RPI visitors center, 11:11191 (R;US)

PUBLIC HEALTH
Development of statistical distributions or ranges of standard factors used in exposure assessments. Final report, 11:12026 (R;US)

PUERTO RICO
Data Acquisition Systems
Design of a centralized network for data acquisition of wind, solar and environmental parameters by using the existing radio telemetry seismic network in Puerto Rico, 11:11206 (RA;PR)
Energy Source Development
Solar energy technologies in Puerto Rico, 11:11182 (RA;PR)
Farms
Energy-integrated farm plan for Puerto Rico, 11:11128 (RA;PR)
Laboratory Buildings
Solar air conditioning, 11:11180 (RA;PR)
Petroleum Refineries
Alcohols and ideas for savings of petroleum crude at local refineries in the Caribbeans, 11:11136 (RA;PR)

Refuse-Fueled Power Plants
Planning waste-to-energy plants in Puerto Rico, 11:11146 (RA;PR)
Renewable Energy Sources
Bamboo as a renewable energy source, 11:11159 (RA;PR)
Energy cane alternative, 11:11160 (RA;PR)
Resource Recovery Facilities
Planning waste-to-energy plants in Puerto Rico, 11:11146 (RA;PR)
Steam Generation Plants
Planning waste-to-energy plants in Puerto Rico, 11:11146 (RA;PR)
Wind Turbines
Correlations between short term and long term wind observation data in Ceer Toa Baja energy experimental farm, 11:11205 (RA;PR)

PULMONARY LAVAGE
See LUNGS

PULSARS
Precession
Pulsar precession: a nod is not as good as a wink, 11:12037 (R;BR)

PULVERIZED FUEL ASH
See FLY ASH

PULVERIZED FUELS
Pneumatic Transport
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)

PUMPED STORAGE POWER PLANTS
Environmental Impacts
Chlorophyll a concentration and distribution in Twin Lakes, Colorado prior to operation of Mt. Elbert Pumped-Storage Powerplant, 1977-1981. Technical report, 11:11154 (R;US)

PUMPS
See also WIND-POWERED PUMPS
Design
Verti Jack Pumping Unit evaluation, 11:10931 (R;US)
Field Tests
Verti Jack Pumping Unit evaluation, 11:10931 (R;US)
Reliability
Reliability of power plant supply pumps and special valves, 11:11272 (RA;CS;In Czech)
Seals
Impact of mechanical- and maintenance-induced failures of main reactor coolant pump seals on plant safety, 11:11336 (R;US)

PUREX PROCESS
Assessment of photochemical applications to specific stages in Savannah River Plant actinide reprocessing streams, 11:10988 (R;US)
Chemical properties of neptunium applied to neptunium management in extraction cycles of Purex process, 11:10984 (R;FR)
Fission Products
Behaviour of palladium in the Purex process, 11:10983 (R;FR)

PURITY
See IMPURITIES

PWR TYPE REACTORS
See also BOHUNICE V-1 REACTOR
CATAWBA-1 REACTOR
CATAWBA-2 REACTOR
CRYSTAL RIVER-3 REACTOR
HARRIS-1 REACTOR
LOFT REACTOR
MILLSTONE-3 REACTOR
OCONEE-1 REACTOR
OCONEE-3 REACTOR
SEABROOK-1 REACTOR
SEABROOK-2 REACTOR
SURRY-1 REACTOR
SURRY-2 REACTOR
SURRY-3 REACTOR
SURRY-4 REACTOR
THREE MILE ISLAND-2 REACTOR
WNP-1 REACTOR
WNP-3 REACTOR
WWER TYPE REACTORS
Availability
Reliability analysis of operating indicators of nuclear power plants, 11:11252 (RA;CS;In Slovak)
Chemical Effluents
Organohalogens in chlorinated cooling waters discharged from nuclear power stations, 11:11255 (R;US)
Containment Systems
Accident assessment: role of the containment radiation monitor, 11:11340 (R;US)
Estimates of early containment loads from core melt accidents. Draft report for comment, 11:11325 (R;US)
Probabilistic risk assessment of filtered-vented containment systems. Mark I BWR, 11:11345 (R;US)
Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels, 11:11348 (R;US)
Two-dimensional empirical model for analyzing steam explosion experiments, 11:11344 (R;US)
Cooling Towers
Organohalogens in chlorinated cooling waters discharged from nuclear power stations, 11:11255 (R;US)
Cost
Breeder reactor economics, 11:11265 (R;US)
ECCS
Research program on mechanical and thermodynamic interactions between principal vapor flow and emergency water injection in a PWR reactor. Volume I. (Part I. EPIS I Experiment) Test Operations, 1975-1976, 11:11357 (TG;US)
Economics
Breeder reactor economics, 11:11265 (R;US)
Engineered Safety Systems
Emergency diesel generator operating experience, 1981-1983, 11:11235 (R;US)
Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)
Environmental Impacts
Organohalogens in chlorinated cooling waters discharged from nuclear power stations, 11:11255 (R;US)
Fuel Assemblies
Trends in thermal calculations for light water reactor fuel (1971-1981), 11:11238 (R;US)
Fuel Element Clusters
MELPROG analysis of the DF-1 severe core damage experiment, 11:11352 (R;US)
Fuel Rods
Fuel Performance Improvement Program. Progress report, April 1984-March 1985, 11:11232 (R;US)
Fuel-Coolant Interactions
Evaluation of the bases for estimating alpha-mode failure probabilities, 11:11350 (R;US)
Recent intermediate-scale experiments on fuel-coolant interactions in an open geometry (EXO-FITS), 11:11351 (R;US)
Loss of Coolant
Accident assessment: role of the containment radiation monitor, 11:11340 (R;US)
Modeling of reflux condensation and countercurrent annular flow in a two-phase closed thermosyphon, 11:11312 (R;US)
Pretest analysis document for Test S-NH-1, 11:11310 (R;US)
TRAC-P1A independent assessment, 1979, 11:11326 (R;US)
TRAC-PF1/MOD 1 independent assessment: Semiscale MOD-2A feedwater-line break (S-SF-3) and steam-line break (S-SF-5) tests, 11:11331 (R;US)
Meltdown
Core material redistribution accompanying accident sequences leading to degraded cores, 11:11346 (R;US)
Estimates of early containment loads from core melt accidents. Draft report for comment, 11:11325 (R;US)
Evaluation of the bases for estimating alpha-mode failure probabilities, 11:11350 (R;US)
Liquid jet breakup characterization with application to melt-water mixing, 11:11295 (R;US)
MELPROG analysis of the DF-1 severe core damage experiment, 11:11352 (R;US)
Recent experiments and analysis regarding steam explosions with simulant molten reactor fuels, 11:11348 (R;US)
Two-dimensional empirical model for analyzing steam explosion experiments, 11:11344 (R;US)

Personnel
Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)
Pipes
Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)
Review of the models and mechanisms for environmentally-assisted crack growth of pressure vessel and piping steels in PWR environments, 11:11524 (R;US)
Pressure Vessels
ORVIRT.PC: a 2-D finite-element fracture analysis program for a microcomputer, 11:11236 (R;US)
Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)
Review of the models and mechanisms for environmentally-assisted crack growth of pressure vessel and piping steels in PWR environments, 11:11524 (R;US)
Primary Coolant Circuits
Modeling of reflux condensation and countercurrent annular flow in a two-phase closed thermosyphon, 11:11312 (R;US)
Reactor Accidents
Probabilistic risk assessment of filtered-vented containment systems. Mark I BWR, 11:11345 (R;US)
Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)
Reactor Components
Aging/Systems Interaction Study, Component Residual Lifetime Evaluation and Feasibility of Relicensing. Progress report, FY 1985, 11:11233 (R;US)
Reactor Cooling Systems
Comparative analysis of constitutive relations in TRAC-PF1 and RELAP5/MOD1, 11:11234 (R;US)
Impact of mechanical- and maintenance-induced failures of main reactor coolant pump seals on plant safety, 11:11336 (R;US)
Reactor Instrumentation
Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)
Reactor Materials
Review of the models and mechanisms for environmentally-assisted crack growth of pressure vessel and piping steels in PWR environments, 11:11524 (R;US)
Reactor Protection Systems
Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)
Reactor Safety
Reactor safety research semiannual report, January-June 1985. Volume 33, 11:11333 (R;US)
Regression Analysis
Reliability analysis of operating indicators of nuclear power plants, 11:11252 (RA;CS;In Slovak)
Reliability
Reliability analysis of operating indicators of nuclear power plants, 11:11252 (RA;CS;In Slovak)
Risk Assessment
Probabilistic risk assessments modeled on a micro-computer, 11:11342 (R;US)
Spent Fuel Elements
Behavior of breached light water reactor spent fuel rods in air and inert atmospheres at 229°C, 11:11047 (J;US)

PYRENE
Oxidation
Oxidation of arenes by molten gallium(III) chloride, 11:11696 (J;GB)
Raman Spectroscopy
Surface-enhanced Raman spectroscopy: a new tool for chemical detection, 11:11608 (R;US)

PYRROLES
See also INDOLES
Chemical Preparation
Ultra high vacuum electrochemistry with conducting polymers, 11:11701 (J;GB)
Electrochemistry
Ultra high vacuum electrochemistry with conducting polymers, 11:11701 (J;GB)
Oxidation
Ultra high vacuum electrochemistry with conducting polymers, 11:11701 (J;GB)
Reduction
Ultra high vacuum electrochemistry with conducting polymers, 11:11701 (J;GB)
Surface Properties
Ultra high vacuum electrochemistry with conducting polymers, 11:11701 (J;GB)

Q

QUANTUM CHROMODYNAMICS
Hadronic Particle Decay
Exclusive decays of heavy mesons into baryons, 11:12215 (J;NL)
Infrared Divergences
Does QCD have infrared renormalons, 11:12222 (R;BR)
Lattice Field Theory
Velocity of sound in SU(3) lattice gauge theory, 11:12262 (J;US)
Mass Spectra
Quarkonia spectra from lattice gauge theories, 11:12266 (J;NL)
Perturbation Theory
[Theoretical elementary particle studies.] Final report, September 1983-July 1985 , 11:12224 (R;US)
Renormalization scheme-dependence of perturbative quantum chromodynamics corrections to quarkonia, 11:12226 (R;US)
Status of perturbative QCD , 11:12223 (R;US)
Renormalization
Renormalization scheme-dependence of perturbative quantum chromodynamics corrections to quarkonia, 11:12226 (R;US)
Scaling Laws
Low-energy theorems from scale currents, 11:12261 (J;US)
Topology
Topological color confinement, 11:12250 (R;SU;In Russian)
Vacuum States
Topological color confinement, 11:12250 (R;SU;In Russian)

QUANTUM ELECTRODYNAMICS
Infrared Divergences
Infrared finiteness in quantum electrodynamics, 11:12267 (BA;NL)
Renormalization
Renormalizations in quantum field theory, 11:12251 (R;SU;In Russian)

QUANTUM FIELD THEORY
See also LAGRANGIAN FIELD THEORY
LATTICE FIELD THEORY
PHI4-FIELD THEORY
QUANTUM CHROMODYNAMICS
QUANTUM ELECTRODYNAMICS
QUANTUM GRAVITY
Group Theory
SO(4) Reduction of the SU(N) Yang—Mills—Dirac equations, 11:12258 (J;US)
Semiclassical Approximation
Quasiclassical approximation for ultralocal scalar fields, 11:12234 (R;BR)
Solitons
Covariant method for soliton matrix elements, 11:12259 (J;US)
Induced charges and tunneling in soliton-antisoliton systems, 11:12260 (J;US)
Yang-Mills Theory
SO(4) Reduction of the SU(N) Yang—Mills—Dirac equations, 11:12258 (J;US)

QUANTUM GRAVITY
String Models
String-generated gravity models, 11:12046 (J;US)

QUANTUM MECHANICS
Estimates of quantum deviations from classical mechanics using large deviation results, 11:12400 (R;FR)
Boundary Conditions
Deficiency indices and singular boundary conditions in quantum mechanics, 11:12401 (R;FR)

Computer Calculations
Multi-scattering-Xα method for analysis of the electronic structure of atomic clusters (MSXALPHA code), 11:12063 (R;CA)
Instability
Stability and instability in quantum mechanics, 11:12399 (R;FR)
Stability
Stability and instability in quantum mechanics, 11:12399 (R;FR)
QUARK CONFINEMENT
See BAG MODEL
QUARK MATERIAL
See QUARK MATTER
QUARK MATTER
Detection
Possible uses of the DLS dipoles in a search for the quark-gluon plasma at the AGS, 11:11814 (R;US)
Research Programs
Search for the formation of the quark-gluon plasma by measurement of cross sections for direct photons and leptons. Annual progress report, April 1, 1985-March 31, 1986, 11:12276 (R;US)
Sound Waves
Velocity of sound in SU(3) lattice gauge theory, 11:12262 (J;US)
QUARK MODEL
See also BAG MODEL
COLOR MODEL
STRING MODELS
Dirac Equation
Potential model for quark confinement, 11:12253 (R;CA)
QUARK PLASMA
See QUARK MATTER
QUARK SEA
See QUARK MATTER
QUARK-GLUON INTERACTIONS
String Models
Production and decay of quark-gluon strings: inclusive distributions of hadrons in psub(tr) and x, 11:12202 (R;SU)
QUARK-GLUON PLASMA
See QUARK MATTER
QUARKONIUM
A hypothetical bound state of quark and antiquark.
Mass Spectra
Quarkonia spectra from lattice gauge theories, 11:12266 (J;NL)
Quantum Chromodynamics
Renormalization scheme-dependence of perturbative quantum chromodynamics corrections to quarkonia, 11:12226 (R;US)
Vector Mesons
Vector meson and axial-vector diquark decay constants, 11:12180 (R;BR)
QUARK-QUARK INTERACTIONS
Elastic Scattering
Hard quark-quark scattering with exclusive reactions, 11:12170 (J;FR)
QUARKS
Color Model
Gentilion hypothesis for quark colours, 11:12239 (R;BR;In Portuguese)
Gentilionic approach to quark colours, 11:12238 (R;BR)
Excited States
Excited quarks and GIM mechanism, 11:12210 (R;AU)
Mass
Asymptotic behavior of quark masses induced by instantons, 11:12184 (R;BR)
Three-Body Problem
Interaction potential for three-particle hadronic systems in the large distance limit, 11:12196 (R;SU)
Wilson Loop
High temperature interparticle potential for an alternative gauge model, 11:12219 (R;BR)
QUARTZ
Frequency Dependence
Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)
Health Hazards
Recommendations concerning an interim annual individual exposure limit for respirable quartz, 11:11077 (R;CA)
Physical Radiation Effects
Thermal conductivity of neutron irradiated quartz, 11:11574 (R;FR)
Sorptive Properties
Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)
QUASI-FREE REACTIONS
Nuclear Models
Quasifree production of hyperons from nuclei, 11:12359 (R;US)
QUEBEC
Geochemical Surveys
Petrography, petrochemistry and mineral associations of selected rocks and radioactive occurrences north of Mont-Laurier, Quebec. A progress report, 11:10973 (RA;CA)
QUINOLINES
Hydrogenation
Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)
Mutagenesis
Mutagen formation in a model beef boiling system. III. Purification and identification of three heterocyclic amine mutagens-carcinogens, 11:12011 (J;US)
QUINONES
Oxidation
One-electron redox reactions in aqueous solutions of sulfite with hydroquinone and other hydroxyphenols, 11:11683 (J;US)
Quantitative Chemical Analysis
Determination of the amount and the type of quinones present in single crystals from reaction center protein from the photosynthetic bacterium Rhodopseudomonas viridis, 11:11705 (J;NL)

R

RACIAL GROUPS
See MINORITY GROUPS
RADIATION ACCIDENTS
Health Hazards
Health effects model for nuclear power plant accident consequence analysis. Part I. Introduction, integration, and summary. Part II. Scientific basis for health effects models, 11:11997 (R;US)
Investigations
Investigation report of the release of strontium-90 from the Building 3517 cell ventilation improvements construction site on November 29, 1985, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 11:11082 (R;US)
Risk Assessment
Summary report on the Seismic Safety Margins Research Program, 11:11338 (R;US)
RADIATION BELTS
Markov Process
Trapping in stochastic mechanics and applications to covers of clouds and radiation belts, 11:12055 (R;FR)
Wave Propagation
Effects of whistler-mode and other waves in the magnetosphere. Final report 1981-1984, 11:12053 (R;US)
RADIATION BURDEN
See RADIATION DOSES
RADIATION CHEMISTRY
Meetings
Third working meeting on radiation interaction. 1, 11:11713 (R;DD)
Third working meeting on radiation interaction. 2, 11:11714 (R;DD)
RADIATION DETECTORS
See also CHERENKOV COUNTERS
DIELECTRIC TRACK DETECTORS
ELECTRON MULTIPLIER DETECTORS

GEIGER-MUELLER COUNTERS
POSITION SENSITIVE DETECTORS
SECONDARY EMISSION DETECTORS
SEMICONDUCTOR DETECTORS
SHOWER COUNTERS

Analog-to-Digital Converters
Fast-response analog-to-digital processor for event selection by the difference in numbers of particles, 11:11835 (R;SU;In Russian)

Design
Automatic material identifier, 11:11101 (J;US)
Radiochemical solar neutrino experiment using $^{81}Br(nu, e^-)^{81}Kr$, 11:12172 (J;US)
Underground science at Homestake, 11:11842 (J;US)

RADIATION DOSEMETERS
See DOSEMETERS

RADIATION DOSES
Calculation Methods
Radioactive cloud dosage calculations, 11:11891 (BA;US)

RADIATION DOSIMETRY
See DOSIMETRY

RADIATION EXPOSURE (DOSES)
See RADIATION DOSES

RADIATION HYGIENE
See RADIATION PROTECTION

RADIATION MONITORS
See also NEUTRON MONITORS

Design
Pocket gamma ray monitor including semiconductor detector and numerical display, 11:11829 (RA;AT)
The Pajarito Monitor: a high-sensitivity monitoring system for highly enriched uranium, 11:11840 (J;US)

RADIATION PROTECTION
Dosimetric aspects, 11:12003 (BA;US)
Internal emitter limits for iodine, radium and radon daughters, 11:12002 (BA;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 4, 11:11075 (R;US)

Occupations
Management perceptions of the Health Physics Technician job, 11:11334 (R;US)

Program Management
Department of Energy briefing session statement, 11:12393 (BA;US)

RADIATION SAFETY
See RADIATION PROTECTION

RADIATION SOURCES
For cosmic sources of radiation see also COSMIC GAMMA SOURCES, COSMIC RADIO SOURCES, and COSMIC X-RAY SOURCES.
See also SYNCHROTRON RADIATION SOURCES

Actinide Isotopes
Preparation of isotopes and sources of actinide elements, 11:11115 (R;FR)

RADIATIVE CAPTURE
See CAPTURE

RADIATIVE DECAY
Reviews
Radiative reactions in two and three nucleon systems, 11:12288 (R;CA)

RADICALS
Not to be used for compound descriptions.
See also HYDROXYL RADICALS

Adsorption
Surface-suppressed electron resonance spectroscopies, 11:11650 (J;US)

Chemical Reactions
Measurement of the $C_3(a^3PI/sub\ u/)$ and $C_2(X^1\Sigma/sub\ g/^+)$ disappearance rates with O_2 from 298 to 1300 kelvin, 11:11710 (J;US)

Dissociation
Ionic dissociation of hydroxycyclohexadienyl radical: effect on ^{13}C hyperfine splittings, 11:11692 (J;US)

Electron Spin Resonance
Surface-suppressed electron resonance spectroscopies, 11:11650 (J;US)

RADIOACTIVE AEROSOLS
Diffusion
Meteorology and atomic energy, 11:11887 (B;US)
Reactor hazard analyses, 11:11892 (BA;US)

Fallout
Radioactive cloud dosage calculations, 11:11891 (BA;US)
Reactor hazard analyses, 11:11892 (BA;US)

Pollution Sources
Air pollution aspects of the atomic energy industry, 11:11888 (BA;US)

Radioecological Concentration
Meteorology and atomic energy, 11:11887 (B;US)
Meteorology in site operations, 11:11889 (BA;US)

RADIOACTIVE BIOLOGICAL WASTES
See RADIOACTIVE WASTES

RADIOACTIVE CLOUDS
Diffusion
Behavior of explosion debris clouds, 11:11890 (BA;US)
Meteorology in site operations, 11:11889 (BA;US)
Radioactive cloud dosage calculations, 11:11891 (BA;US)

RADIOACTIVE GASEOUS WASTES
See GASEOUS WASTES
RADIOACTIVE WASTES

RADIOACTIVE MATERIALS
See also FISSION PRODUCTS
RADIOACTIVE WASTES

Road Transport
Developments over the last two years concerning nuclear transportation and federal preemption, 11:10992 (R;US)

Routing
Assessment of the US Department of Transportation's radioactive materials routing report, 11:10991 (R;US)

Transport
Insurance-indemnity coverage for nuclear transportation: an overview, 11:11083 (R;US)

Transport Regulations
Developments over the last two years concerning nuclear transportation and federal preemption, 11:10992 (R;US)

RADIOACTIVE PARTICULATES
See RADIOACTIVE AEROSOLS

RADIOACTIVE TRACERS
See RADIOPHARMACEUTICALS

RADIOACTIVE WASTE DISPOSAL
Directories
Information Services Directory, 11:11006 (R;US)

Engineered Safety Systems
Disposal materials study, 11:11034 (R;US)

Evaluation
Evaluation of "Commercial Repository Capacity for the Disposal of Defense High-Level Waste." Response to comments, 11:10999 (R;US)

Grouting
Annual technology assessment and progress report for the Buried Transuranic Waste Program at the Idaho National Engineering Laboratory (Shallow land burial), 11:11012 (R;US)

Information Dissemination
Information Services Directory, 11:11006 (R;US)

International Cooperation
Stripa project quarterly report. October through December 1984, 11:11023 (R;SE)

Laws
Radioactive waste management: a summary of state laws and administration. National Low-Level Radioactive Waste Management Program. Revision 6, 11:11001 (R;US)

Legislation
Radioactive waste management: a summary of state laws and administration. National Low-Level Radioactive Waste Management Program. Revision 6, 11:11001 (R;US)

Packaging
Radioactive waste isolation in salt: peer review of Westinghouse Electric Corporation's report on reference conceptual designs for a repository waste package, 11:10997 (R;US)
Review of DOE Waste Package Program. Semiannual report, October 1984-March 1985. Volume 8, 11:11025 (R;US)

Public Opinion
Evaluation of "Commercial Repository Capacity for the Disposal of Defense High-Level Waste." Response to comments, 11:10999 (R;US)

Radionuclide Migration
Importance of the source term for the release of radionuclides from a repository in a salt dome, 11:11062 (RA;US)
Quantification of source-term profiles from near-field geochemical models, 11:11065 (RA;US)
Reliable predictions of waste performance in a geologic repository, 11:11059 (R;US)
System tests for studying the release of radioactivity from high-level waste forms under geological disposal conditions, 11:11067 (RA;US)
Research Programs
Defense radioactive waste management activities: an overview, 11:11050 (J;US)
Defense waste and byproducts management monthly report, November 1985, 11:11032 (R;US)
PAGIS summary report of phase 1: a common methodological approach based on European data and models, 11:11016 (R;IT)
Site Selection
Geohydrology of rocks penetrated by test well USW H-4, Yucca Mountain, Nye County, Nevada, 11:11040 (R;US)
Managing the nation's nuclear waste. Site descriptions: Cypress Creek, Davis Canyon, Deaf Smith, Hanford Reference, Lavender Canyon, Richton Dome, Swisher, Vacherie Dome, and Yucca Mountain, 11:11007 (R;US)
Source Terms
Initial results for the experimental evaluation of a nuclear waste repository source term model, 11:11048 (J;US)
Underground Disposal
Calculated solubilities of actinides and some fission and activation products under disposal conditions, 11:10996 (R;GB)
Proposal for a research programme on geological disposal of radioactive waste in the Netherlands. At the request of the Integrated National Research Program - Nuclear Waste (ILONA) Policy Committee, 11:11017 (R;NL)
Safety assessment of underground nuclear waste repositories using the method of status vectors, 11:11035 (R;DD;In German)
Specification of a test problem for HYDROCOIN Level 1 Case 4: transient thermal convection in a saturated permeable medium, 11:10995 (R;GB)

RADIOACTIVE WASTE FACILITIES
See also WIPP
Environmental Impacts
Environmental assessment of repository sites considerations and methodology, 11:11071 (J;US)
Evaluation
Technical evaluation of the G.E. Transportable Modular AZTECH Plant topical report, 11:11014 (R;US)
Licensing
Objective of the NRC high-level research program at BNL, 11:11054 (J;US)
Performance
Source-term considerations for a potential radioactive-waste repository located in unsaturated tuff, 11:11064 (RA;US)
System tests for studying the release of radioactivity from high-level waste forms under geological disposal conditions, 11:11067 (RA;US)
Site Selection
Environmental assessment of repository sites considerations and methodology, 11:11071 (J;US)
Implementation status of NWPA requirements and relevant activities of the repository projects, 11:11052 (J;US)
Site Surveys
Progress toward the second respository--status, 11:11055 (J;US)

RADIOACTIVE WASTE MANAGEMENT
Computerized Simulation
Alternatives and optimization of the waste management system, 11:11056 (J;US)
Design
Alternatives and optimization of the waste management system, 11:11056 (J;US)
Laws
Radioactive waste management: a summary of state laws and administration. National Low-Level Radioactive Waste Management Program. Revision 6, 11:11001 (R;US)
Legislation
Radioactive waste management: a summary of state laws and administration. National Low-Level Radioactive Waste Management Program. Revision 6, 11:11001 (R;US)
Optimization
Alternatives and optimization of the waste management system, 11:11056 (J;US)
Program Management
Program Management System manual, 11:11008 (R;US)
Research Programs
Defense radioactive waste management activities: an overview, 11:11050 (J;US)

RADIOACTIVE WASTE PROCESSING
Adsorbents
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Calcination
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Evaluation
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Inorganic Ion Exchangers
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Isotopic Exchange
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Meetings
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Research Programs
Defense waste and byproducts management monthly report, October 1985, 11:11033 (R;US)
Defense waste and byproducts management monthly report, November 1985, 11:11032 (R;US)

RADIOACTIVE WASTE STORAGE
See also MONITORED RETRIEVABLE STORAGE
Design Basis Accidents
Radiological consequences of brine release by human intrusion into WIPP, 11:11923 (R;US)
Hazards
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)
Information Needs
Characterization plan for Solid Waste Storage Area 6, 11:11027 (R;US)
Research Programs
Defense radioactive waste management activities: an overview, 11:11050 (J;US)
Defense waste and byproducts management monthly report, October 1985, 11:11033 (R;US)
Defense waste and byproducts management monthly report, November 1985, 11:11032 (R;US)
Risk Assessment
Radiological consequences of brine release by human intrusion into WIPP, 11:11923 (R;US)

RADIOACTIVE WASTES
See also ALPHA-BEARING WASTES
HIGH-LEVEL RADIOACTIVE WASTES
LOW-LEVEL RADIOACTIVE WASTES
Ground Disposal
Ground disposal of radioactive wastes at the Hanford site, 11:11901 (R;US)

Materials Handling
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)
Radiolysis
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)
Solubility
Calculated solubilities of actinides and some fission and activation products under disposal conditions, 11:10996 (R;GB)
Radiological water decontamination study, 11:11918 (R;US)
Stack Disposal
Air pollution aspects of the atomic energy industry, 11:11888 (BA;US)
Transport
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)

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RADIOAPPLICATORS
See RADIATION SOURCES

RADIOBIOLOGY
Research Programs
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RADIOFREQUENCY SYSTEMS
See RF SYSTEMS

RADIOISOTOPE GENERATORS
Zirconium molybdate gel as a generator for technetium-99m, 11:11716 (R;AU)
Design
Detection and quantitation of left-to-right shunting by iridium-191m angiography, 11:11717 (R;US)
Performance Testing
Detection and quantitation of left-to-right shunting by iridium-191m angiography, 11:11717 (R;US)

RADIOISOTOPE MIGRATION
See RADIONUCLIDE MIGRATION

RADIOISOTOPE-LABELLED DRUGS
See RADIOPHARMACEUTICALS

RADIOISOTOPES
See also NEUTRON-RICH ISOTOPES
Ionization
Methods for on-line production of radioactive ion-beams in the $2 < Z < 21$ region, 11:12065 (R;CH)

RADIOLOGICAL PROTECTION
See RADIATION PROTECTION

RADIONUCLIDE CONCENTRATION
See RADIOACTIVITY

RADIONUCLIDE MIGRATION
In environment.
Waste Isolation Pilot Plant Safety Analysis Report. Volume 3, 11:11074 (R;US)
Bench-Scale Experiments
Laboratory simulation of radionuclide geological migration, 11:11068 (RA;US)
Chemical Reaction Kinetics
Release mechanisms and their role in the spent fuel repository perfomance, 11:11037 (RA;US)
Computerized Simulation
Development and applications of two finite element groundwater flow and contaminant transport models: FEWA and FEMA, 11:11058 (R;US)
Forecasting
Reliable predictions of waste performance in a geologic repository, 11:11059 (R;US)
Mathematical Models
Contour-to-grid methods for the ARAC system, 11:11886 (R;US)
Source-term considerations for a potential radioactive-waste repository located in unsaturated tuff, 11:11064 (RA;US)
Tracer Techniques
Coupled lakes model for estimating the long-term response of the Great Lakes to time-dependent loadings of particle-associated contaminants. Technical Memo., 11:11919 (R;US)

RADIONUCLIDE TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION

RADIONUCLIDES
See RADIOISOTOPES

RADIOPHARMACEUTICALS
Biological Radiation Effects
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Chemical Composition
Tin-117M-labeled stannic (SN^{4+}) chelates, 11:11982 (P;US)
Chemical Preparation
Tin-117M-labeled stannic (SN^{4+}) chelates, 11:11982 (P;US)

RADIOPRESERVATION
Evaluation
Irradiation as a process in competition with deep-freezing, 11:11116 (RA;DE;In German)

RADIOSURGERY
See RADIOTHERAPY

RADIOTHERAPY
Whole-Body Irradiation
In vivo measurement of lithium in the body by a neutron activation analysis technique, 11:11980 (J;US)

RADIUM 226
Radiation Monitoring
Radioactive substances in building materials. A compilation of results from samples examined at SSI, 11:12392 (R;SE;In Swedish)
Radiochemical Analysis
Techniques of sample attack used in soil and mineral analysis. Phase I, 11:11614 (R;CA)

RADIUM A
See POLONIUM 218

RADIUM D
See LEAD 210

RADIUM ISOTOPES
See also RADIUM 226
Radiation Hazards
Internal emitter limits for iodine, radium and radon daughters, 11:12002 (BA;US)

RADON
Radiation Monitoring
OECD/NEA Radon Intercalibration and Intercomparison Programme Pacific Region Intercomparison Programme, 11:12388 (R;AU)

RADON 209
Yrast States
Yrast spectroscopy of ^{209}Rn, 11:12340 (R;AU)

RADON 211
High Spin States
Magnetic moments, E3 transitions and the structure of high spin core excited states in ^{211}Rn, 11:12341 (R;AU)

RADON 222
Air Pollution Abatement
Indoor air quality: sources and control, 11:11873 (J;US)
Air Pollution Control
Indoor air quality: sources and control, 11:11873 (J;US)
Indoor Air Pollution
Indoor air quality: sources and control, 11:11873 (J;US)
Radioecological Concentration
Progress in indoor radon measurement. Review of previous research (July 1981-February 1985), 11:11881 (R;US)

RAILROAD CARS
Fuel Substitution
Use of coal-water fuels in a contemporary steam locomotive, 11:10884 (RA;US)

RAILWAYS
Economics
Delivering coal without the dust and noise, 11:10848 (RA;US)
Environmental Impacts
Delivering coal without the dust and noise, 11:10848 (RA;US)

RAMAN EFFECT
Plasma Simulation
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RAMAN SPECTROSCOPY
Prior to March 1983 this concept was indexed to RAMAN SPECTRA.
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RARE EARTH COMPOUNDS
See also CERIUM COMPOUNDS
EUROPIUM COMPOUNDS
LANTHANUM COMPOUNDS
YTTERBIUM COMPOUNDS
Solid Solutions
Substantial solid solutions of bismuth-containing lanthanide dititanates, Ln/sub 2-x/Bi/sub x/Ti_2O_7, 11:11564 (J;US)

RARE EARTHS
See also CERIUM
GADOLINIUM
HOLMIUM
LUTETIUM
NEODYMIUM
YTTERBIUM
Diffusion
Experimentation and modelling of U, Th, and lanthanides transport in fissured rocks. Influence of complexation, 11:11057 (R;FR)
Solvent Extraction
Actinide-lanthanide group separation using sulfur and nitrogen donor extractants, 11:11606 (R;FR)
Preliminary separation of the lanthanide group using DHDECMP, 11:11604 (R;FR)

RDF
See REFUSE DERIVED FUELS

REACTOR ACCIDENTS
See also LOSS OF COOLANT
LOSS OF FLOW
MELTDOWN
REACTOR CORE DISRUPTION
Fission Product Release
Concept of underground nuclear power plant siting for retaining post accident atmospheres, 11:11354 (R;US)
Human Factors
Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)
Radiation Hazards
Consideration of resource privation by severe reactor accidents, 11:11356 (J;US)
Risk Assessment
Probabilistic risk assessment of filtered-vented containment systems. Mark I BWR, 11:11345 (R;US)
Uses of human reliability analysis probabilistic risk assessment results to resolve personnel performance issues that could affect safety, 11:11329 (R;US)

REACTOR COMPONENTS
See also BREEDING BLANKETS
REACTOR COOLING SYSTEMS
REACTOR CORES
Acoustic Emission Testing
On-line acoustic emission monitoring of nuclear reactor systems: status and future, 11:11270 (R;US)
Aging
Aging/Systems Interaction Study, Component Residual Lifetime Evaluation and Feasibility of Relicensing. Progress report, FY 1985, 11:11233 (R;US)
Decontamination
Decontamination of nuclear power plant equipment with chlorinated hydrocarbon-based solutions and emulsions, 11:11719 (RA;CS;In Czech)
Hoisting
Hoisting and rigging of critical components and related equipment. Revision, 11:11274 (R;US)
Mechanical Vibrations
Utility machinery vibration monitoring guide (Interim), 11:11226 (R;US)
Performance
Aging/Systems Interaction Study, Component Residual Lifetime Evaluation and Feasibility of Relicensing. Progress report, FY 1985, 11:11233 (R;US)
Stress Corrosion
BWR pipe crack and weld clad overlay studies, 11:11231 (R;US)

REACTOR CONTROL SYSTEMS
Performance Testing
Potential safety enhancements to nuclear plant control: Proof testing at EBR-II, 11:11277 (BA;US)
Reliability
Guidelines for reliability analysis of control elements and systems of nuclear power plants, 11:11276 (RA;CS;In German)
Research Programs
Potential safety enhancements to nuclear plant control: Proof testing at EBR-II, 11:11277 (BA;US)

REACTOR COOLING SYSTEMS
See also PRIMARY COOLANT CIRCUITS
RHR SYSTEMS
SECONDARY COOLANT CIRCUITS
Decontamination
Decontamination of nuclear power plant equipment, 11:11718 (RA;CS;In Czech)
Heat Transfer
Comparative analysis of constitutive relations in TRAC-PF1 and RELAP5/MOD1, 11:11234 (R;US)
Hydraulics
Comparative analysis of constitutive relations in TRAC-PF1 and RELAP5/MOD1, 11:11234 (R;US)
Pollution Regulations
Compliance of the Savannah River Plant P-Reactor cooling system with environmental regulations. Demonstrations in accordance with Sections 316(a) and (b) of the Federal Water Pollution Control Act of 1972, 11:11922 (R;US)
Pumps
Impact of mechanical- and maintenance-induced failures of main reactor coolant pump seals on plant safety, 11:11336 (R;US)

REACTOR CORE DISRUPTION
Chemical Reactions
Analysis of hydrogen production during a BWR6 core heatup transient, 11:11296 (R;US)

REACTOR CORES
Computer Codes
Core neutronics code development and application, 11:11269 (RA;US)
Heat Transfer
Overview of TRAC-BD1/MOD1 assessment studies, 11:11337 (R;US)
Hydraulics
Overview of TRAC-BD1/MOD1 assessment studies, 11:11337 (R;US)

REACTOR DECOMMISSIONING
Cost
Decommissioning a boiling water reactor nuclear power plant, 11:11339 (R;US)
Radiation Protection
Decommissioning a boiling water reactor nuclear power plant, 11:11339 (R;US)
Research Programs
Community's research and development programme on decommissioning of nuclear power plants. Fourth annual progress report (year 1983), 11:11227 (R;LU)

REACTOR INSTRUMENTATION
See also IN CORE INSTRUMENTS
Quality Assurance
Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)

REACTOR MAINTENANCE
Human Factors Engineering
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REACTOR MATERIALS
To be assigned in conjunction with the specific descriptor for the material used in a reactor, provided this descriptor is not yet up-posted to reactor materials.
Mechanical Properties
Measurement and prediction of sensitization development in austenitic stainless steels, 11:11526 (R;US)
Review of the models and mechanisms for environmentally-assisted crack growth of pressure vessel and piping steels in PWR environments, 11:11524 (R;US)

Study of energy loss and its mechanisms in Homalite 100 during crack propagation and arrest, 11:11569 (R;US)
Physical Properties
Study of energy loss and its mechanisms in Homalite 100 during crack propagation and arrest, 11:11569 (R;US)
Stress Corrosion
BWR pipe crack and weld clad overlay studies, 11:11231 (R;US)
Thermomechanical Treatments
Measurement and prediction of sensitization development in austenitic stainless steels, 11:11526 (R;US)

REACTOR OPERATORS
Performance Testing
Nuclear power plant simulation facility evaluation methodology: handbook. Volume 1, 11:11266 (R;US)
Training
Nuclear power plant simulation facility evaluation methodology: handbook. Volume 1, 11:11266 (R;US)
Nuclear Studies Training Program. Final report, 11:12513 (R;US)

REACTOR PROTECTION SYSTEMS
See also ECCS
In Core Instruments
Fast reactor status review. Development work on core protective instrumentation, 11:11358 (TJ;GB)
Quality Assurance
Qualification Testing Evaluation (QTE) program for safety-related equipment, 11:11343 (R;US)

REACTOR SAFETY
Nuclear Safety, Volume 25, No. 4. Technical progress review, July-August 1984, 11:11353 (R;US)
Research Programs
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Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)

REACTOR SIMULATORS
Evaluation
Nuclear power plant simulation facility evaluation methodology: handbook. Volume 1, 11:11266 (R;US)
Performance Testing
Nuclear power plant simulation facility evaluation methodology: handbook. Volume 1, 11:11266 (R;US)

REACTORS
See also WATER COOLED REACTORS
WATER MODERATED REACTORS
Analytical Solution
Analytical solution for a first-order reaction in a packed bed with diffusion, 11:11665 (J;US)
Radiation Hazards
Reactor hazard analyses, 11:11892 (BA;US)
Reactivity Meters
Introduction to panel on "Where do we go from here", 11:11268 (R;US)
Subcriticality
Introduction to panel on "Where do we go from here", 11:11268 (R;US)

REAGENTS
See also RHODAMINES
STARCH
Chemical Composition
Tin-117M-labeled stannic (SN^{4+}) chelates, 11:11982 (P;US)
Chemical Preparation
Tin-117M-labeled stannic (SN^{4+}) chelates, 11:11982 (P;US)

RECIPROCAL TRANSLOCATIONS
See CHROMOSOMAL ABERRATIONS

RECLAMATION
See LAND RECLAMATION

RECOMBINATION
Of electrons, holes, ions, radicals or atoms.
Catalysts
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)

RECYCLE (FUEL)
See FUEL CYCLE

RECYCLING (FUEL)
See REPROCESSING

REFERENCE MATERIALS (STANDARD)
See CALIBRATION STANDARDS

REFRACTORIES
Corrosion
Corrosion of ceramic refractories exposed to a synthetic coal slag by means of the rotating-drum technique (Spinel, chromia; spinel, magnesia; alumina-chromia), 11:11552 (R;US)

REFRACTORY METALS
Chemistry
Application of quantum chemistry to atmospheric chemistry. Final report, 1 October 1983-30 September 1984, 11:11639 (R;US)

REFRIGERANTS
Evaporation
Controlling a cooling medium evaporator with an electrically-driven injection valve, 11:11465 (RA;DE;In German)
Materials Handling
Expansion chambers in the refrigeration circuit, 11:11475 (RA;DE;In German)
Thermodynamic Properties
Development of a residential gas fired absorption heat pump. Physical and thermodynamic properties of R123A/ETFE system development and testing economic analysis. Final report, 11:11447 (R;US)

REFRIGERATING MACHINERY
Remote Control
Remote monitoring of refrigeration and air conditioning systems with the air of BBC-York's TELEGUARD system, 11:11474 (RA;DE;In German)
Remote Handling Equipment
Remote monitoring of refrigeration and air conditioning systems with the air of BBC-York's TELEGUARD system, 11:11474 (RA;DE;In German)

REFRIGERATORS
See also HELIUM DILUTION REFRIGERATORS
SOLAR REFRIGERATORS
Coefficient of Performance
Energy consumption of various different switching systems for compound equipment in supermarkets, 11:11425 (RA;DE;In German)
Comparative Evaluations
Energy consumption of various different switching systems for compound equipment in supermarkets, 11:11425 (RA;DE;In German)
Design
Comparative studies on deep freeze distribution vehicles, 11:11497 (RA;DE;In German)
Energy Conservation
Ways of optimizing refrigeration and deep-freeze equipment energy-wise, 11:11423 (RA;DE;In German)
Optimization
Ways of optimizing refrigeration and deep-freeze equipment energy-wise, 11:11423 (RA;DE;In German)
Performance
Evaporators, expansion chambers and defrosting processes for industrial refrigerators, 11:11427 (RA;DE;In German)
Vehicle refrigeration, 11:11496 (RA;DE;In German)
Specifications
Vehicle refrigeration, 11:11496 (RA;DE;In German)

REFUSE
See SOLID WASTES

REFUSE DERIVED FUELS
Production
Energy from wastes, current technology, 11:11147 (RA;PR)

REFUSE-FUELED POWER PLANTS
Planning
Planning waste-to-energy plants in Puerto Rico, 11:11146 (RA;PR)

REGOLITH
See OVERBURDEN

RELATIVISTIC PLASMA
Electromagnetic Radiation
Electromagnetic wave propagation in relativistic magnetized plasmas, 11:12467 (J;US)

RELEASE (FISSION PRODUCT)
See FISSION PRODUCT RELEASE
RELIABILITY
Computer Calculations
Computer-aided reliability analysis of complex systems, 11:11253 (RA;CS;In Czech)
REMOVAL (AFTER-HEAT)
See AFTER-HEAT REMOVAL
RENEWABLE ENERGY SOURCES
See also BIOMASS
GEOTHERMAL ENERGY
SOLAR ENERGY
WAVE POWER
WIND POWER
Meetings
Energy sources: conservation and renewables, 11:11450 (B;US)
Research Programs
Hawaii Natural Energy Institute annual report, July 1982-June 1983, 11:11405 (R;US)
Hawaii Natural Energy Institute annual report, July 1981-June 1982, 11:11383 (R;US)
Hawaii Natural Energy Institute annual report, 1984, 11:11384 (R;US)
RENORMALIZATION
Monte Carlo Method
Improved Monte Carlo Renormalization Group Method, 11:12252 (R;US)
REPROCESSING
See also PUREX PROCESS
Adsorbents
Inorganic ion exchangers and adsorbents for chemical processing in the nuclear fuel cycle. Proceedings of a technical committee meeting organized by the IAEA and held in Vienna, 12-15 June 1984, 11:11019 (R;XA)
Flowsheets
Five years experience of pulse columns extraction cycles for the reprocessing of fast breeder reactor fuels at the Marcoule pilot plant (SAP), 11:10987 (R;FR)
Inorganic Ion Exchangers
Inorganic ion exchangers and adsorbents for chemical processing in the nuclear fuel cycle. Proceedings of a technical committee meeting organized by the IAEA and held in Vienna, 12-15 June 1984, 11:11019 (R;XA)
Meetings
Inorganic ion exchangers and adsorbents for chemical processing in the nuclear fuel cycle. Proceedings of a technical committee meeting organized by the IAEA and held in Vienna, 12-15 June 1984, 11:11019 (R;XA)
REPUBLIC OF KOREA
Coal Preparation Plants
CoaLiquid, Inc. coal slurry fuels commercial program - 1985, 11:10843 (RA;US)
RESEARCH PROGRAMS
To be used jointly with descriptor(s) for subject field and/or organization concerned.
Financing
Fiscal year 1986 Department of Energy authorization (fossil energy). Volume 1. Hearing before the Subcommittee on Energy Development and Applications of the Committee on Science and Technology, US House of Representatives, Ninety-Ninth Congress, First Session, March 6, 1985, 11:11386 (B;US)
Recommendations
Conventional combustion, 11:10898 (RA;US)
Preparation, handling, and storage, 11:10851 (RA;US)
RESEARCH REACTORS
See also BRR REACTOR
FFTF REACTOR
HFIR REACTOR
OSIRIS REACTOR
PSTR REACTOR
UFTR REACTOR
Design
Ultra high flux reactor design: probing the limits of plate fuel technology (Thermal neutron flux exceeding 10^{16} n/cm^2.s), 11:11283 (R;US)
Dispersion Nuclear Fuels
Thermal conductivities of U_3Si and U_3Si_2-Al dispersion fuels, 11:11280 (R;US)
Neutron Flux
Ultra high flux reactor design: probing the limits of plate fuel technology (Thermal neutron flux exceeding 10^{16} n/cm^2.s), 11:11283 (R;US)
RESERVOIR PRESSURE
Computer Calculations
HEADCO: a program for converting observed water levels and pressure measurements to formation pressure and standard hydraulic head, 11:12030 (R;US)
RESIDENCES
See HOUSES
RESIDENTIAL BUILDINGS
See also HOUSES
Air Source Heat Pumps
Improvement of operational behaviour of a heating system equipped with a water/air source heat pump, 11:11435 (RA;DE;In German)
Appliances
Economics of efficiency improvements in residential appliances and space conditioning equipment, 11:11455 (J;US)
Energy Audits
Determinants of actual electricity savings after retrofit: electrically heated homes in the Pacific Northwest, 11:11420 (R;US)
Energy Conservation
Vapor-compression heat pump system field tests at the TECH complex, 11:11456 (J;US)
Energy Efficiency
Affordable manufactured housing through energy conservation. A guide to designing and constructing energy efficient manufactured homes, 11:11443 (R;US)
Determinants of actual electricity savings after retrofit: electrically heated homes in the Pacific Northwest, 11:11420 (R;US)
Energy Efficiency Standards
Envelope design implications of ASHRAE Standard 90.1P: a case study view, 11:11449 (R;US)
Heat Pumps
Vapor-compression heat pump system field tests at the TECH complex, 11:11456 (J;US)
Heating Systems
Balance-sheet of a large-scale heat pump system for heating a residential complex, 11:11432 (RA;DE;In German)
Passive Solar Heating Systems
Optimising three building projects by means of passive solar energy: Wald (Canton Zurich), Schuepfen (Canton Berne) and Preverenges (Canton Vaud), 11:11416 (RA;CH;In German)
Radiation Monitoring
Progress in indoor radon measurement. Review of previous research (July 1981-February 1985), 11:11881 (R;US)
Solar Architecture
Multi-family houses with built-in conservatories, 11:11414 (RA;CH;In German)
Solar Heating Systems
Dimetrodon performance summary: energy systems and the evolution of an ecological community design process, 11:11445 (R;US)
Space HVAC Systems
Economics of efficiency improvements in residential appliances and space conditioning equipment, 11:11455 (J;US)
Thermal Mass
Statistically based parametric analysis of exterior envelope thermal mass effect predictions, 11:11417 (R;US)
Wind Turbines
Dimetrodon performance summary: energy systems and the evolution of an ecological community design process, 11:11445 (R;US)
Wood Burning Furnaces
Dimetrodon performance summary: energy systems and the evolution of an ecological community design process, 11:11445 (R;US)
RESIDENTIAL SECTOR
Energy Consumption
Residential energy efficiency: progress since 1973 and future potential (Cost of conserved concept), 11:11451 (J;US)

Energy Efficiency
Residential energy efficiency: progress since 1973 and future potential (Cost of conserved concept), 11:11451 (J;US)
RESIDUAL FUEL OIL
See RESIDUAL FUELS
RESIDUAL FUELS
Atomization
Experience with the NRC burner assembly, 11:10881 (RA;US)
Combustion
Experience with the NRC burner assembly, 11:10881 (RA;US)
RESIDUAL HEAT REMOVAL
See RHR SYSTEMS
RESIDUES
See also ASHES
Gasification
Liquefaction, 11:10739 (RA;US)
RESIDUES (RADIOACTIVE)
See RADIOACTIVE WASTES
RESIDUUMS
See RESIDUAL FUELS
RESINS
Decomposition
Low level waste data base development - EPICOR-II resin/liner investigation. Program review, 11:11013 (R;US)
Solidification
Low level waste data base development - EPICOR-II resin/liner investigation. Program review, 11:11013 (R;US)
RESONANCE FLUORESCENCE
Photons
To test photon statistics by atomic beam deflection, 11:12083 (R;IT)
RESOURCE ASSESSMENT
Computer Calculations
Correlations between short term and long term wind observation data in Ceer Toa Baja energy experimental farm, 11:11205 (RA;PR)
RESOURCE DEVELOPMENT
Program and financial report on Department of Energy, 11:11385 (R;US)
Economic Impact
Proposed fiscal year 1986 budget request. Hearings before the Committee on Energy and Natural Resources, United States Senate, Ninety-Ninth Congress, First Session, February 27, March 1 and 4, 1985, 11:11380 (B;US)
Government Policies
Proposed fiscal year 1986 budget request. Hearings before the Committee on Energy and Natural Resources, United States Senate, Ninety-Ninth Congress, First Session, February 27, March 1 and 4, 1985, 11:11380 (B;US)
RESOURCE MANAGEMENT
Economic Impact
Proposed fiscal year 1986 budget request. Hearings before the Committee on Energy and Natural Resources, United States Senate, Ninety-Ninth Congress, First Session, February 27, March 1 and 4, 1985, 11:11380 (B;US)
Government Policies
Proposed fiscal year 1986 budget request. Hearings before the Committee on Energy and Natural Resources, United States Senate, Ninety-Ninth Congress, First Session, February 27, March 1 and 4, 1985, 11:11380 (B;US)
RESOURCE RECOVERY FACILITIES
Economics
Energy from wastes, current technology, 11:11147 (RA;PR)
Planning
Planning waste-to-energy plants in Puerto Rico, 11:11146 (RA;PR)
Technology Assessment
Energy from wastes, current technology, 11:11147 (RA;PR)
RESPIRABLE DUSTS
See DUSTS
RESPIRATORY SYSTEM
See also LUNGS
Biological Hot Spots
Surrogate experimental models for studying particle deposition in the human respiratory tract, 11:11871 (R;US)
RETINA
Electron Microprobe Analysis
Cation shifts in human retina-choroid, 11:11965 (R;US)
X-Ray Emission Analysis
Cation shifts in human retina-choroid, 11:11965 (R;US)
RETORTED SHALES
See SPENT SHALES
RETORTS
Sweep Efficiency
Characterization of a non-uniform retort using tracer techniques, 11:10971 (J;US)
Thermal Analysis
Characterization of a non-uniform retort using tracer techniques, 11:10971 (J;US)
Tracer Techniques
Characterization of a non-uniform retort using tracer techniques, 11:10971 (J;US)
RETROFITTING
Decision Making
Modernisation of the energy engineering in large buildings, as in the example of Freiburg University, 11:11433 (RA;DE;In German)
REVERSE COMBUSTION
Feasibility Studies
Status of the joint Belgo-German experiment of underground coal gasification, 11:10745 (RA;US)
REVERSE-FIELD PINCH
Flute Instability
Dynamics and fluctuation spectra of electrostatic resistive interchange turbulence, 11:12437 (R;US)
Plasma Macroinstabilities
Linear studies of resistive interchange modes in a cylindrical reversed field pinch, 11:12463 (J;US)
RF SYSTEMS
Power Supplies
K500 RF power supply, 11:11799 (RA;US)
RHODAMINES
Adsorption
High-pressure study of rhodamine B in solution and adsorbed on oriented single-crystal ZnO, 11:11690 (J;US)
Aqueous Solutions
High-pressure study of rhodamine B in solution and adsorbed on oriented single-crystal ZnO, 11:11690 (J;US)
Emission Spectra
Laser induced coal fluorescence. Twelfth quarterly technical progress report, July 1-September 31, 1985, 11:10798 (R;US)
RHODIUM
Catalytic Effects
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)
Surface Properties
Effect of potassium on the chemisorption of carbon monoxide on the Rh(111)crystal face, 11:11666 (J;NL)
RHODOPSEUDOMONAS
Photosynthesis
Determination of the amount and the type of quinones present in single crystals from reaction center protein from the photosynthetic bacterium Rhodopseudomonas viridis, 11:11705 (J;NL)
RHR SYSTEMS
Heat Transfer
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
Hydraulics
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
RICHLAND FFTF REACTOR
See FFTF REACTOR
RIEMANN WAVES
See SHOCK WAVES
RINGS (STORAGE)
See STORAGE RINGS
RISA
See ORGANIC IODINE COMPOUNDS
RISER CRACKING
See COAL LIQUEFACTION
RISK ANALYSIS
See RISK ASSESSMENT

RISK ASSESSMENT
Value impact assessment of standard review plan sections, 11:11347 (R;US)
Computerized Simulation
Probabilistic risk assessments modeled on a micro-computer, 11:11342 (R;US)
RISKS
See HAZARDS
RIVER BEND-1 REACTOR
St. Francisville, Louisiana, USA
Reactor Safety
Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, River Bend, Unit 1, 11:11308 (R;US)
ROADS
Federal Assistance Programs
Financial and Compliance Report on Federally Assisted Programs for the year ended June 30, 1984, 11:11376 (R;US)
Traffic Control
Study of current and planned high occupancy vehicle lane use: performance and prospects, 11:11462 (R;US)
ROCK BURSTS
Research Programs
Strata control investigations in the Sydney coalfield - Annual report, January 1 to December 31, 1984, 11:10819 (R;CA)
ROCK SALT
See SALT DEPOSITS
ROCKET ENGINES
Propellants
Criteria for ignition in monopropellant engines, 11:11780 (R;US)
Measurements of distributed combustion. Annual report, March 1983-June 1984, 11:11781 (R;US)
ROCKS
See also SEDIMENTARY ROCKS
SYNTHETIC ROCKS
Compression Strength
Strength and deformation properties of various rocks from the Springhill coal mine, Nova Scotia, 11:10821 (R;CA)
RODS (FUEL)
See FUEL RODS
ROOFS
Thermal Efficiency
Dynamic thermal performance of light weight insulated low-slope roof systems, 11:11419 (R;US)
Thermal Insulation
Dynamic thermal performance of light weight insulated low-slope roof systems, 11:11419 (R;US)
ROOTS
Plant Growth
Identification of calmodulin released by osmotic shock of maize roots, 11:11971 (RA;US)
ROSSI ALPHA METHOD
Rossi Alpha Method, 11:11284 (R;US)
ROTATING PLASMA
Dispersion Relations
Electromagnetic solitary vortices in rotating plasma, 11:12435 (R;US)
Drift Instability
Electromagnetic solitary vortices in rotating plasma, 11:12435 (R;US)
Isotope Separation
Isotope separation in a rotational plasma, 11:12472 (TJ;AU)
Vortices
Electromagnetic solitary vortices in rotating plasma, 11:12435 (R;US)
RUBIDIUM
Boiling Points
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Critical Pressure
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Critical Temperature
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Melting Points
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Photoionization
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
RUTHENIUM
Soil Chemistry
Ground disposal of radioactive wastes at the Hanford site, 11:11901 (R;US)
RUTHENIUM 106
Diffusion
Investigation of siting parameters for near surface disposal of low-level nuclear waste. Final report, 11:11000 (R;US)
RUTHENIUM CHLORIDES
Chemical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Isomerization
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
Physical Properties
Comparisons of the physical and chemical properties of isomeric pairs. 2. Photochemical, thermal, and electrochemical cis-trans isomerizations of $M(Ph_2PCH_2PPh_2)_2Cl_2$ (M = Ru/sup II/, Os/sup II), 11:11669 (J;US)
RUTHENIUM COMPLEXES
Chemical Preparation
Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)
Photochemistry
Polypyridyl hydrido complexes of osmium(II) and ruthenium(II), 11:11668 (J;US)
RUTHENIUM COMPOUNDS
See also RUTHENIUM CHLORIDES
Chemical Preparation
Synthesis and properties of novel electroactive organometallic polymers. Annual progress report, March 7-December 1, 1985, 11:11673 (R;US)
Crystal Structure
Synthesis and properties of novel electroactive organometallic polymers. Annual progress report, March 7-December 1, 1985, 11:11673 (R;US)
Electrochemistry
Relationships between electronic spectroscopy and electrochemistry. A probe of reorganisation energies. Technical report, 11:11638 (R;CA)
Electron Spectroscopy
Relationships between electronic spectroscopy and electrochemistry. A probe of reorganisation energies. Technical report, 11:11638 (R;CA)
Molecular Structure
Synthesis and properties of novel electroactive organometallic polymers. Annual progress report, March 7-December 1, 1985, 11:11673 (R;US)
RUTHERFORD SCATTERING
Uses
Applications of heavy-ion Rutherford backscattering spectrometry (HIRBS) to the analysis of contact structures on GaAs and Ge, 11:11543 (J;NL)

S

S MATRIX
Euclidean Space
Hopf equation for an infinite-dimensional phase space dynamical system and Euclidean quantum field theory, 11:12245 (R;SU;In Russian)

SABOTAGE
Reporting Requirements
Proposed Revision 1 to Regulatory Guide 5.62: reporting of physical security events. Draft regulatory guide and value/impact statement, 11:11264 (R;US)
SAFEGUARDS
An activated barrier for protection of special nuclear materials in vital areas, 11:11102 (J;US)
Design
Design and evaluation of an integrated safeguards system: principles, 11:11092 (J;US)
Evaluation
Design and evaluation of an integrated safeguards system: principles, 11:11092 (J;US)
Research Programs
Demonstration of the calorimetric assay of large mass, high burn-up PuO_2 samples, 11:11107 (J;US)
SAFETY (NUCLEAR)
See RADIATION PROTECTION
SAFETY (REACTOR)
See REACTOR SAFETY
SAFETY STANDARDS
Evaluation
Preliminary radiation protection tests for the body height and body weight of the Chinese reference man, 11:12394 (TG;US)
SALINE ZONE
See OIL SHALES
SALT CAVERNS
Rock Mechanics
Stress control technique: its history and suitability for WIPP, 11:11041 (R;US)
Support Pillars
Stress control technique: its history and suitability for WIPP, 11:11041 (R;US)
SALT DEPOSITS
Connate Water
Origin of fluid inclusion water in bedded salt deposits, Palo Duro Basin, Texas, 11:10998 (R;US)
Creep
Waste Isolation Pilot Plant. Quarterly geotechnical field data report, April-June 30, 1985, 11:11009 (R;US)
Deformation
Waste Isolation Pilot Plant. Quarterly geotechnical field data report, April-June 30, 1985, 11:11009 (R;US)
Geologic Structures
Basic data report: borehole WIPP-12 deepening. Waste Isolation Pilot Plant (WIPP) Project, southeastern New Mexico, 11:11044 (R;US)
Basic data report for borehole DOE-1. Waste Isolation Pilot Plant (WIPP) Project, Southeastern New Mexico, 11:11045 (R;US)
Lithology
Basic data report for borehole DOE-1. Waste Isolation Pilot Plant (WIPP) Project, Southeastern New Mexico, 11:11045 (R;US)
Radioactive Waste Disposal
Importance of the source term for the release of radionuclides from a repository in a salt dome (Gorleben), 11:11062 (RA;US)
Stratigraphy
Basic data report for borehole DOE-1. Waste Isolation Pilot Plant (WIPP) Project, Southeastern New Mexico, 11:11045 (R;US)
Stresses
Waste Isolation Pilot Plant. Quarterly geotechnical field data report, April-June 30, 1985, 11:11009 (R;US)
SAMARIUM 151
Shell Models
Fragmentation of subshells in rare earth nuclei, 11:12337 (R;SU;In Russian)
Strength Functions
Fragmentation of subshells in rare earth nuclei, 11:12337 (R;SU;In Russian)
SAND PRESSURE
See RESERVOIR PRESSURE
SANITARY LANDFILLS
Degassing
Energy from wastes, current technology, 11:11147 (RA;PR)
SAPPHIRE
Ion Implantation
Hardness of ion implanted ceramics, 11:11556 (R;US)
SAVANNAH RIVER PLANT
Reactor Cooling Systems
Compliance of the Savannah River Plant P-Reactor cooling system with environmental regulations. Demonstrations in accordance with Sections 316(a) and (b) of the Federal Water Pollution Control Act of 1972, 11:11922 (R;US)
Research Programs
Ecological research at the Savannah River Ecology Laboratory. Annual report for the period ending July 31, 1985, 11:11921 (R;US)
SAVANNAH RIVER PLANT P REACTOR
See P REACTOR
SCALAR FIELDS
O Groups
Derivative expansion of the effective action, 11:12264 (J;US)
Semiclassical Approximation
Quasiclassical approximation for ultralocal scalar fields, 11:12234 (R;BR)
SCALAR MESONS
Particle Production
JADE: search for new particles and tests of Standard Model, 11:12146 (RA;US)
SCANNING ELECTRON MICROSCOPY
Research Programs
Spectroscopy of surface adsorbed molecules (scanning tunneling microscopy). Progress report, May 1, 1985-April 30, 1986 (Scanning tunneling microscopy), 11:12396 (R;US)
SCHISTOSOMA
Excretion
Comparison of Schistosoma mansoni migration patterns in normal and irradiated cercaria-immunized mice by means of autoradiographic analysis. Evidence that worm elimination occurs after the skin phase in immunized mice, 11:11987 (R;US)
Platyhelminths
Murine immunization by cesium-137 irradiation attenuated Schistosoma mansoni cercariae, 11:11992 (R;US)
Tissue Distribution
Comparison of Schistosoma mansoni migration patterns in normal and irradiated cercaria-immunized mice by means of autoradiographic analysis. Evidence that worm elimination occurs after the skin phase in immunized mice, 11:11987 (R;US)
SCHOOL BUILDINGS
Solar Water Heating
Potential applications of solar energy in the Republic of Panama, 11:11179 (RA;PR)
SCHOTTKY BARRIER DIODES
Photoluminescence
Photoluminescent response of palladium-cadmium sulfide and palladium-graded cadmium sulfoselenide Schottky diodes to molecular hydrogen. Technical report, 11:11571 (R;US)
SCHROEDINGER EQUATION
Hamiltonians
New Schroedinger equations for old: Inequivalence of the Darboux and Abraham-Moses constructions, 11:12415 (J;US)
SCOTLAND
See UNITED KINGDOM
SCRUBBERS
See also DRY SCRUBBERS
Pilot Plants
Alkaline and Stretford scrubbing tests for H_2S removal from in-situ oil retort offgas. Final report, February 1983-February 1985, 11:10968 (R;US)
Sludges
Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas, 11:10802 (RA;US)
SEABROOK-1 REACTOR
Seabrook, New Hampshire, USA

Reactor Safety
Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, Seabrook Units 1 and 2 (Docket Nos. 50-443 and 50-444), 11:11307 (R;US)
SEABROOK-2 REACTOR
Seabrook, New Hampshire
Reactor Safety
Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, Seabrook Units 1 and 2 (Docket Nos. 50-443 and 50-444), 11:11307 (R;US)
SEALS
Failures
Impact of mechanical- and maintenance-induced failures of main reactor coolant pump seals on plant safety, 11:11336 (R;US)
SEAS
See also ATLANTIC OCEAN
PACIFIC OCEAN
Water Pollution
Oil in the sea: inputs, fates, and effects. Final report, 11:10941 (R;US)
SECONDARY BATTERIES
See ELECTRIC BATTERIES
SECONDARY COOLANT CIRCUITS
Heat Transfer
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
Hydraulics
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
SECONDARY EMISSION DETECTORS
Design
Microchannel plate zero time detector, 11:11818 (RA;US)
SECTORAL ANALYSIS
Energy Models
Engineering/economic end-use energy models, 11:11375 (J;US)
SECURITY
Systems Analysis
Maintenance and the upgraded security system, 11:11109 (J;US)
SECURITY PERSONNEL
Training
Developing a curriculum for training nuclear protective force persons in legal matters, 11:11110 (J;US)
SEDIMENTARY ROCKS
Compression Strength
Study of rock behaviour for the Donkin-Morien rock/support interaction contract, 11:10822 (R;CA)
Tensile Properties
Study of rock behaviour for the Donkin-Morien rock/support interaction contract, 11:10822 (R;CA)
SEDIMENTS
Chemical Composition
Trace element geochemistry of the South Atlantic Bight. Progress report, 11:11907 (R;US)
Heat Transfer
ISHTE: component test cruise report. In Situ Heat Transfer Experiment (Atlas Cruise, Leg 1), September 1984, 11:11039 (R;US)
Stratigraphy
Trace element geochemistry of the South Atlantic Bight. Progress report, 11:11907 (R;US)
SEISMIC SURVEYS
Data Analysis
Geological and geochemical implications of gas hydrates in the Gulf of Mexico. Final report, 11:10958 (R;US)
SEISMIC WAVES
Excitation
L/sub g/ wave excitation and propagation with application to nuclear yield determination. Final report 1 Apr 83-31 Mar 85, 11:11854 (R;US)
Scattering
L/sub g/ wave excitation and propagation with application to nuclear yield determination. Final report 1 Apr 83-31 Mar 85, 11:11854 (R;US)
SELENIUM
Activation Analysis
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)
Gel Permeation Chromatography
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)
X-Ray Fluorescence Analysis
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)
SELENIUM 82 TARGET
Argon 40 Reactions
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
SEM (MICROSCOPY)
See SCANNING ELECTRON MICROSCOPY
SEMICONDUCTOR COUNTERS
See SEMICONDUCTOR DETECTORS
SEMICONDUCTOR DETECTORS
See also SI SEMICONDUCTOR DETECTORS
Response Functions
Improved model of electron interaction with matter to be used for calculation of detector's response function, 11:11832 (RA;AT)
SEMICONDUCTOR MATERIALS
If possible index also the specific compounds.
Birefringence
Birefringence relaxation for semiconductor minority-carrier lifetime measurement. Final report, 11:11848 (R;US)
Carrier Lifetime
Birefringence relaxation for semiconductor minority-carrier lifetime measurement. Final report, 11:11848 (R;US)
Melting
Modeling of complex melting and solidification behavior in laser-irradiated materials [a description and users guide to the LASER8 computer program], 11:11584 (R;US)
Physical Radiation Effects
Pulsed-laser annealing effects in Si, 11:11599 (J;GB)
Transport Theory
Photothermal investigation of transport in semiconductors: Theory and experiment, 11:11590 (J;US)
SENIOR CENTERS
See PUBLIC BUILDINGS
SEWAGE SLUDGE
Combustion
Planning waste-to-energy plants in Puerto Rico, 11:11146 (RA;PR)
Waste Product Utilization
Coal-sludge mixtures - a sensible coal slurry fuel, 11:10831 (RA;US)
SHALE OIL
Gas Chromatography
Aspects of high-resolution gas chromatography as applied to the analysis of hydrocarbon fuels and other complex organic mixtures. Volume 2. Survey of sample-insertion techniques. Final report, January-September 1980, 11:11603 (R;US)
Quantitative Chemical Analysis
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)
SHEAR
Measuring Methods
Method and apparatus for measuring shear modulus and viscosity of a monomolecular film, 11:11766 (P;US)
SHEARON HARRIS-1 REACTOR
See HARRIS-1 REACTOR
SHELLS
Structural forms; for electron shells in atoms use ELECTRONIC STRUCTURE.
Mechanical Vibrations
Combined experimental/analytical modeling of shell/payload structures, 11:11742 (R;US)

Stress Analysis
Elasto-plastic creep analysis of an exisymmetric shell subject to pure thermal loading, 11:11744 (R;GB)
Thermal Analysis
Elasto-plastic creep analysis of an exisymmetric shell subject to pure thermal loading, 11:11744 (R;GB)
SHIPMENT
See TRANSPORT
SHOCK WAVES
See also DETONATION WAVES
Interactions
Rayleigh—Taylor stability for a normal shock wave—density discontinuity interaction, 11:12133 (J;US)
Velocity
Rayleigh—Taylor stability for a normal shock wave—density discontinuity interaction, 11:12133 (J;US)
SHOPPING CENTERS
Design
Central refrigeration for use in supermarkets, 11:11426 (RA;DE;In German)
Energy Conservation
Development trends in refrigeration equipment for supermarkets, 11:11424 (RA;DE;In German)
Refrigerators
Central refrigeration for use in supermarkets, 11:11426 (RA;DE;In German)
Development trends in refrigeration equipment for supermarkets, 11:11424 (RA;DE;In German)
Energy consumption of various different switching systems for compound equipment in supermarkets, 11:11425 (RA;DE;In German)
Space HVAC Systems
Low-cost, energy-saving air conditioning systems for department stores and supermarkets, 11:11431 (RA;DE;In German)
SHORT CIRCUITS
See ELECTRICAL FAULTS
SHORT ROTATION CULTIVATION
Research Programs
Short Rotation Woody Crops Program. Quarterly progress report, June 1-August 31, 1985, 11:11163 (R;US)
SHOWER COUNTERS
Detects high energy gamma radiation or high energy particles on basis of cascade showers in layered absorbers.
Computerized Simulation
OPAL experiment at LEP: P. Rapp progress report, 11:11807 (RA;US)
Construction
OPAL experiment at LEP: P. Rapp progress report, 11:11807 (RA;US)
Design
OPAL experiment at LEP: P. Rapp progress report, 11:11807 (RA;US)
Soudan nucleon decay experiments, 11:11844 (J;US)
Installation
OPAL experiment at LEP: P. Rapp progress report, 11:11807 (RA;US)
Performance
Deep inelastic muon scattering at Fermilab - status report, 11:12148 (RA;US)
Soudan nucleon decay experiments, 11:11844 (J;US)
SHRIMP
Ecology
Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico). Grass shrimp, 11:11910 (R;US)
SHUTIN PRESSURE
See RESERVOIR PRESSURE
SI SEMICONDUCTOR DETECTORS
Performance
Application of Si detectors, photo-diodes and G-M counters in exposure rate measurements, 11:11823 (RA;AT)
SIALON
See ALUMINIUM OXIDES
SILICON NITRIDES
SIGMA-MINUS ATOMS
See HADRONIC ATOMS
SILANES
Electron Mobility
Effect of high pressure on the electron mobility in liquid n-hexane, 2,2-dimethylbutane, and tetramethylsilane, 11:11686 (J;US)
Formation Heat
Theoretical study of the heats of formation of SiH/sub n/, SiCl/sub n/, and SiH/sub n/Cl/sub n/ compounds, 11:11653 (J;US)
SILICA
Chemical Reactions
Removal of oxide contamination from silicon carbide powders, 11:11565 (J;US)
Removal
Removal of oxide contamination from silicon carbide powders, 11:11565 (J;US)
Sorptive Properties
Standardization of alumina and silica adsorbents used for chemical class separations of polycyclic aromatic compounds, 11:11632 (J;US)
Surface Properties
Local structure of metal atoms in silica and silicates. Progress report, May 15-December 1, 1985, 11:11578 (R;US)
SILICATE MINERALS
Physical Radiation Effects
Phosphorescence in irradiated spodumene (Gamma radiation), 11:11582 (R;BR)
SILICON
Activation Analysis
Activation analysis, 11:11609 (RA;US)
Annealing
Effects of thermal donor generation and annihilation upon oxygen precipitation, 11:11587 (R;US)
Chemical Vapor Deposition
Laser-heated CVD process for depositing thin films for low-cost solar cell applications. Annual subcontract progress report, 1 February 1984-31 May 1985, 11:11168 (R;US)
Deposition
Research on high-efficiency, single-junction, monolithic, thin-film a-Si solar cells. Annual subcontract progress report, 1 February 1984-31 January 1985, 11:11165 (R;US)
Electron Channeling
Channeling-radiation measurements at Lawrence Livermore National Laboratory, 11:11597 (J;NL)
Laser-Radiation Heating
Time-resolved reflectivity measurements of silicon and germanium pulsed excimer laser irradiation, 11:11576 (R;US)
Melting
Time-resolved reflectivity measurements of silicon and germanium pulsed excimer laser irradiation, 11:11576 (R;US)
Microstructure
Effects of thermal donor generation and annihilation upon oxygen precipitation, 11:11587 (R;US)
NMR Spectra
Direct spectroscopic observation of molecular hydrogen by high resolution proton NMR and a reinterpretation of the proton NMR spectra for amorphous Si:H, 11:11575 (R;FR)
Phonons
Dipole activity of surface phonons on Si(111)2 x 1, 11:11591 (J;US)
Physical Radiation Effects
Dose rate effects in silicon during heavy ion irradiation, 11:11596 (J;NL)
Dose rate dependence of damage clustering during heavy ion irradiation in Si, 11:11594 (J;GB)
Pulsed-laser annealing effects in Si, 11:11599 (J;GB)
Positron Channeling
Channeling-radiation measurements at Lawrence Livermore National Laboratory, 11:11597 (J;NL)
Sorptive Properties
Silicon (111) and (100) surfaces and their interactions with Sc, K, Na and Li; phase changes and kinetics of desorption studied by surface ionization, 11:11667 (J;NL)
X-Ray Spectra
Systematics of K X-ray satellite structure excited by heavy-ion impact, 11:12075 (RA;US)

SILICON 28 REACTIONS
Backscattering
Role of peripheral partial waves in the anomalous large angle scattering of n-α nuclei, 11:12366 (R;BR)
Elastic Scattering
Role of peripheral partial waves in the anomalous large angle scattering of n-α nuclei, 11:12366 (R;BR)
Spallation
Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 11:12308 (J;NL)
SILICON 28 TARGET
Oxygen 16 Reactions
Effects of the dynamic α-transfer polarization potential in the large-angle scattering of $^{16}O+^{28}Si$, 11:12315 (R;BR)
SILICON 33
Energy Levels
Masses and level schemes of ^{33}Si and ^{34}Si, 11:12310 (R;AU)
Mass Defect
Masses and level schemes of ^{33}Si and ^{34}Si, 11:12310 (R;AU)
SILICON 34
Energy Levels
Masses and level schemes of ^{33}Si and ^{34}Si, 11:12310 (R;AU)
Mass Defect
Masses and level schemes of ^{33}Si and ^{34}Si, 11:12310 (R;AU)
SILICON ALLOYS
Interstitials
Enhanced diffusion from interstitial trapping during solid-phase-epitaxial growth of silicon alloys, 11:11600 (J;NL)
Recrystallization
Enhanced diffusion from interstitial trapping during solid-phase-epitaxial growth of silicon alloys, 11:11600 (J;NL)
SILICON CARBIDES
Chemical Reactions
Removal of oxide contamination from silicon carbide powders, 11:11565 (J;US)
Ion Implantation
Amorphization and recrystallization processes in monocrystalline beta silicon carbide thin films, 11:11555 (R;US)
Optical Properties
Investigations of hard, carbon-based surface coatings: from "diamond-like" carbon to silicon carbide. Progress report, July 1, 1985-June 30, 1986 (a-Si/sub 1-x/C/sub x/:H), 11:11579 (R;US)
SILICON CHLORIDES
Formation Heat
Theoretical study of the heats of formation of SiH/sub n/, SiCl/sub n/, and SiH/sub n/Cl/sub n/ compounds, 11:11653 (J;US)
SILICON COMPOUNDS
See also SILANES, SILOXANES and SILICONES.
See also SILANES
SILICON CARBIDES
SILICON CHLORIDES
SILICON NITRIDES
SILICON OXIDES
Benzene
Silicon analog of benzene—hexasilabenzene (Si_6H_6), 11:12100 (J;US)
Bond Lengths
Silicon analog of benzene—hexasilabenzene (Si_6H_6), 11:12100 (J;US)
Chemical Preparation
Preparation of $Yb[N(SiMe_3)_2]_3[AiMe_3]_3$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
Crystal Structure
Preparation of $Yb[N(SiMe_3)_2]_3[AiMe_3]_3$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
Electronic Structure
Silicon analog of benzene—hexasilabenzene (Si_6H_6), 11:12100 (J;US)
Vibrational States
Silicon analog of benzene—hexasilabenzene (Si_6H_6), 11:12100 (J;US)
SILICON HYDRIDES
See SILANES
SILICON IONS
Ion-Atom Collisions
Production of projectile and target K X-rays by single and multiple electron capture in collisions of Si^{14+} and Si^{13+} ions with argon atoms at 4.5 and 5.5 MeV/amu, 11:12064 (R;FR)
SILICON NITRIDES
Chemical Reaction Kinetics
Silicon nitride joining, 11:11560 (J;US)
Joining
Silicon nitride joining, 11:11560 (J;US)
Pressing
Silicon nitride joining, 11:11560 (J;US)
SILICON OXIDES
See also QUARTZ
SILICA
Chemical Preparation
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6O$/sub 2-0.5x/ system, 11:11651 (J;US)
Lattice Parameters
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6O$/sub 2-0.5x/ system, 11:11651 (J;US)
Neutron Diffraction
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6O$/sub 2-0.5x/ system, 11:11651 (J;US)
X-Ray Diffraction
X-ray and neutron powder diffraction study of the Ca/sub 2+x/Nd/sub 8-x/$(SiO_4)_6O$/sub 2-0.5x/ system, 11:11651 (J;US)
SILICON SEMICONDUCTOR DETECTORS
See SI SEMICONDUCTOR DETECTORS
SILICON SOLAR CELLS
Fabrication
Laser-heated CVD process for depositing thin films for low-cost solar cell applications. Annual subcontract progress report, 1 February 1984-31 May 1985, 11:11168 (R;US)
Research Programs
Research on high-efficiency, single-junction, monolithic, thin-film a-Si solar cells. Annual subcontract progress report, 1 February 1984-31 January 1985, 11:11165 (R;US)
Research on high-efficiency, stacked, multijunction, amorphous silicon alloy thin-film solar cells. A semiannual subcontract progress report, 1 October 1984-15 May 1985, 11:11169 (R;US)
Research on high-efficiency, single-junction, monolithic thin-film amorphous silicon solar cells. Semiannual subcontract progress report, 1 October 1984-31 March 1985, 11:11166 (R;US)
SILOXANES
Solvation
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
SILVER
Binding Energy
Probing the wave function of a surface state in Ag(111): A new approach, 11:11537 (J;US)
Energy Levels
Probing the wave function of a surface state in Ag(111): A new approach, 11:11537 (J;US)
Sorptive Properties
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
Orientation of CH_3NC adsorbed on Ag(311), 11:11680 (J;US)
Surface-suppressed electron resonance spectroscopies, 11:11650 (J;US)
SILVER 108 TARGET
Alpha Reactions
Emission of light fragments ^3H, ^3He and ^4He in ^4He-nucleus collisions at 3.33 GeV/N kinetic energy, 11:12369 (R;SU)
SILVER IODIDES
Atom Transport
Use of computer simulation technique to study atomic migration in solids, 11:11577 (R;US)

Correlation Functions
Use of computer simulation technique to study atomic migration in solids, 11:11577 (R;US)
Crystal Growth
Use of computer simulation technique to study atomic migration in solids, 11:11577 (R;US)
Crystal Structure
Molecular dynamics studies of structural transformation in solids, 11:11549 (J;CH)
Single-crystal neutron diffraction study of the distribution and thermal motion of silver ions in alpha- and beta-Ag_3SI, 11:11573 (R;US)
Crystal-Phase Transformations
Use of computer simulation technique to study atomic migration in solids, 11:11577 (R;US)

SILVER SULFIDES
Crystal Structure
Single-crystal neutron diffraction study of the distribution and thermal motion of silver ions in alpha- and beta-Ag_3SI, 11:11573 (R;US)
Molecular Structure
Use of computer simulation technique to study atomic migration in solids, 11:11577 (R;US)

SIMS
See MASS SPECTROSCOPY

SIMULATORS
See also REACTOR SIMULATORS
Design
Example motion sensor test results using the Sandia Intruder Motion Simulator, 11:11104 (J;US)
Performance Testing
Example motion sensor test results using the Sandia Intruder Motion Simulator, 11:11104 (J;US)

SIMULATORS (REACTOR)
See REACTOR SIMULATORS

SINGLE CRYSTALS
See MONOCRYSTALS

SKELETON
Grafts
Effects of irradiation on frozen corticocancellous bone allograft incorporation and immunogenicity. Final report, 11:11988 (R;US)
Radiotherapy
Tin-117M-labeled stannic (SN^{4+}) chelates, 11:11982 (P;US)
Scintiscanning
Tin-117M-labeled stannic (SN^{4+}) chelates, 11:11982 (P;US)

SLAGS
Chemical Composition
Corrosion of ceramic refractories exposed to a synthetic coal slag by means of the rotating-drum technique, 11:11552 (R;US)
Viscosity of low-rank coal slags, 11:10904 (RA;US)
Corrosive Effects
Corrosion of ceramic refractories exposed to a synthetic coal slag by means of the rotating-drum technique, 11:11552 (R;US)
Crystallization
Crystallization behavior of coal gasification ash, 11:10805 (J;US)
Viscosity
Gasification, 11:10736 (RA;US)
Viscosity of low-rank coal slags, 11:10904 (RA;US)

SLEEVES
Design
Heat flux limiting sleeves, 11:11259 (P;US)

SLUDGES
See also SEWAGE SLUDGE
Leaching
Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas, 11:10802 (RA;US)
Waste Disposal
Applicability of column leaching data to the design of fly ash and FGD disposal sites in surface-mined areas, 11:10802 (RA;US)

SLUGS (FUEL)
See FUEL RODS

SLURRIES (FUEL)
See FUEL SLURRIES

SLURRY PIPELINES
Comparative Evaluations
Energy efficiency comparison of coal slurry transportation systems, 11:10847 (RA;US)
Economics
Delivering coal without the dust and noise, 11:10848 (RA;US)
Energy Efficiency
Energy efficiency comparison of coal slurry transportation systems, 11:10847 (RA;US)
Environmental Impacts
Delivering coal without the dust and noise, 11:10848 (RA;US)
Planning
Western Resource Transport project: a liquid carbon dioxide/coal slurry pipeline, 11:10850 (RA;US)
Technology Assessment
Western Resource Transport project: a liquid carbon dioxide/coal slurry pipeline, 11:10850 (RA;US)

SMALL-SCALE HYDROELECTRIC POWER PLANTS
Garland Canal Shoshone Irrigation District hydroelectric project: final operations and maintenance report. Small-Scale Hydroelectric Power Demonstration Project, 11:11152 (R;US)
Construction
"Rancho Hydro": a low-head, high volume residential hydroelectric power system, Anahola, Kauai, Hawaii, 11:11151 (R;US)
Performance
New York State Electric and Gas Corporation Upper Mechanicville hydroelectric redevelopment project: final operation and maintenance report. Small-Scale Hydroelectric Power Demonstration Project, 11:11153 (R;US)

SNG
See HIGH BTU GAS

SNG PROCESSES
See also HYGAS PROCESS
Comparative Evaluations
Economic evaluation of methanol and SNG production using UCG, 11:10755 (RA;US)
Economic Analysis
Economic evaluation of methanol and SNG production using UCG, 11:10755 (RA;US)
GRI perspective on UCG as an SNG supply option, 11:10757 (RA;US)
UCG - derived synthesis gas: an economic comparison, 11:10758 (RA;US)
Feasibility Studies
GRI perspective on UCG as an SNG supply option, 11:10757 (RA;US)
UCG - derived synthesis gas: an economic comparison, 11:10758 (RA;US)
Technology Utilization
Economic evaluation of methanol and SNG production using UCG, 11:10755 (RA;US)

SO-6 GROUPS
Decomposition of the SO(6) symmetric representations into SU(2)xSU(2)xU(1), 11:12217 (R;FR)

SODIUM
Activation Analysis
Study and application of ion chromatography and activation analysis without chemical separation for the determination of sodium and potassium in muscle tissues, 11:11615 (R;BR;In Portuguese)
Boiling Points
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Catalytic Effects
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)
Critical Pressure
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)

Critical Temperature
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Desorption
Silicon (111) and (100) surfaces and their interactions with Sc, K, Na and Li; phase changes and kinetics of desorption studied by surface ionization, 11:11667 (J;NL)
Ion Exchange Chromatography
Study and application of ion chromatography and activation analysis without chemical separation for the determination of sodium and potassium in muscle tissues, 11:11615 (R;BR;In Portuguese)
Leaching
Hydrothermal studies of simulated defense waste glass plus basalt, 11:11030 (R;US)
Melting Points
Assessment of the melting, boiling, and critical point data of the alkali metals, 11:11538 (J;GB)
Removal
Design, cost and economic benefits of ion exchange process to remove sodium from lignite, 11:10853 (RA;US)
X-Ray Spectra
Systematics of K X-ray satellite structure excited by heavy-ion impact, 11:12075 (RA;US)

SODIUM CHLORIDES
Catalytic Effects
Sodium chloride as a catalyst for the gasification of coal char. Final report, Tasks 8 and 9, 11:10741 (R;US)
Interference
Suppression of analyte signal by various concomitant salts in inductively coupled plasma mass spectrometry, 11:11625 (J;US)
Vapor Pressure
Sodium chloride as a catalyst for the gasification of coal char. Final report, Tasks 8 and 9, 11:10741 (R;US)

SODIUM CITRATES
See SODIUM COMPOUNDS

SODIUM COMPOUNDS
See also SODIUM CHLORIDES
SODIUM OXIDES
Chemical Analysis
Sodium in low-rank coal, 11:10797 (R;US)
Phase Stability
VPI-3 alkali attack of coal gasifier refractory linings. Progress report No. 4, October 1-December 31, 1985, 11:10779 (R;US)

SODIUM COOLED REACTORS
See also EBR-2 REACTOR
FFTF REACTOR
Decontamination
Decontamination of nuclear power plant equipment, 11:11718 (RA;CS;In Czech)

SODIUM IODIDE DETECTORS
See NAI DETECTORS

SODIUM LAURYL SULFATES
See SODIUM COMPOUNDS

SODIUM MINERALS
See MINERALS

SODIUM OXIDES
Metallurgical Effects
Crystallization behavior of coal gasification ash, 11:10805 (J;US)

SODIUM-SULFUR BATTERIES
Performance
Posttest analysis of beta (Na/S) cells from chloride silent power, limited. Final report, 11:11370 (R;US)
Research Programs
Sodium-sulfur battery development. Phase VB, October 1, 1981-February 28, 1985. Final report, 11:11369 (R;US)

SODIUM-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS

SOILS
Disposal materials study, 11:11034 (R;US)
Contamination
Lead as an environmental pollutant, 11:11895 (RA;XE)
Leaching
Effects of acid precipitation on a typical quartzipsamment soil in Florida, 11:11896 (R;US)
Radioactivity
Residual radioactive contamination at Maralinga and Emu, 1985, 11:11898 (R;AU)
Radionuclide Migration
Elemental tritium deposition and conversion in the terrestrial environment, 11:11899 (R;CA)
Investigation of siting parameters for near surface disposal of low-level nuclear waste. Final report, 11:11000 (R;US)
Progress in indoor radon measurement. Review of previous research (July 1981-February 1985), 11:11881 (R;US)
Sorptive Properties
Sorption and desorption of volatile chlorinated aliphatic compounds by soils and soil components. Doctoral theses, 11:11914 (R;US)
Water Pollution Control
Sorption and desorption of volatile chlorinated aliphatic compounds by soils and soil components. Doctoral theses, 11:11914 (R;US)

SOLAR AIR CONDITIONERS
Design
Solar air conditioning, 11:11180 (RA;PR)

SOLAR ARCHITECTURE
Computerized Simulation
Optimising three building projects by means of passive solar energy: Wald (Canton Zurich), Schuepfen (Canton Berne) and Preverenges (Canton Vaud), 11:11416 (RA;CH;In German)

SOLAR CELLS
See also CADMIUM SULFIDE SOLAR CELLS
CADMIUM TELLURIDE SOLAR CELLS
CASCADE SOLAR CELLS
COPPER SELENIDE SOLAR CELLS
GALLIUM ARSENIDE SOLAR CELLS
SILICON SOLAR CELLS
Data Acquisition Systems
Method and apparatus for I-V data acquisition from solar cells, 11:11172 (P;US)

SOLAR COLLECTORS
See also CONCENTRATING COLLECTORS
SOLAR PONDS
Calculation Methods
Recurrence relation for the calculation of sections of compound conical concentrators, 11:11161 (RA;PR)
Design
Development of simple air collectors for drying agricultural produce in developing countries, 11:11197 (RA;DE;In German)
Recurrence relation for the calculation of sections of compound conical concentrators, 11:11161 (RA;PR)

SOLAR DRYERS
Performance
Planning and operating instructions for agricultural batch drying machinery with air-pre-heating by means of solar energy, 11:11189 (RA;DE;In German)

SOLAR DRYING
Solar Collectors
Development of simple air collectors for drying agricultural produce in developing countries, 11:11197 (RA;DE;In German)

SOLAR ENERGY
Energy Source Development
Solar energy technologies in Puerto Rico, 11:11182 (RA;PR)
Research Programs
Hawaii Natural Energy Institute annual report, July 1982-June 1983, 11:11405 (R;US)
Hawaii Natural Energy Institute annual report, July 1981-June 1982, 11:11383 (R;US)
Hawaii Natural Energy Institute annual report, 1984, 11:11384 (R;US)
Resource Potential
Potential applications of solar energy in the Republic of Panama, 11:11179 (RA;PR)

SOLAR FURNACES
Combustion Products
Hydrogen and sulfur from hydrogen sulfide-4. Quenching the effluent from a solar furnace, 11:11121 (J;GB;RU)

SOLAR HEATING SYSTEMS
See also PASSIVE SOLAR HEATING SYSTEMS
Performance
Dimetrodon performance summary: energy systems and the evolution of an ecological community design process, 11:11445 (R;US)
SOLAR NEUTRINOS
Prior to July, 1975 information was indexed to NEUTRINOS.
Neutrino Detection
Radiochemical solar neutrino experiment using ^{81}Br(nu, e$^-$)^{81}Kr, 11:12172 (J;US)
Underground science at Homestake, 11:11842 (J;US)
Radiation Detection
Underground neutrino astronomy, 11:12176 (J;US)
SOLAR ONE POWER PLANT
See BARSTOW SOLAR PILOT PLANT
SOLAR PONDS
Technology Assessment
Major design, and operational considerations of salt-gradient solar ponds, 11:11183 (RA;PR)
SOLAR REFRIGERATORS
Heat Transfer
Study of solar solid adsorption ice-maker using 13 X zeolite - water couple in tropical climate, 11:11181 (RA;PR)
Mass Transfer
Study of solar solid adsorption ice-maker using 13 X zeolite - water couple in tropical climate, 11:11181 (RA;PR)
Technology Assessment
Study of solar solid adsorption ice-maker using 13 X zeolite - water couple in tropical climate, 11:11181 (RA;PR)
SOLAR THERMAL CONVERSION
Use for overviews of solar thermal program.
Technology Assessment
State of solar energy technology, 11:11404 (RA;PR)
SOLAR THERMAL POWER PLANTS
Economic Analysis
Economic evaluations of solar thermal energy systems using a levelized energy cost approach, 11:11177 (R;US)
SOLAR WATER HEATERS
Design
Solar water heater for tropical countries, 11:11184 (RA;PR)
Mathematical Models
Solar water heater for tropical countries, 11:11184 (RA;PR)
Performance
Solar water heater for tropical countries, 11:11184 (RA;PR)
SOLID CLUSTERS
Growth
Morphology of a class of kinetic-growth models, 11:12417 (J;US)
SOLID FUELS
See also DISPERSION NUCLEAR FUELS
Production
Food crop versus energy-crop production in the Caribbean, 11:11138 (RA;PR)
SOLID STATE LASERS
See also NEODYMIUM LASERS
Crystal Growth Methods
Research in gadolinium scandium gallium garnet (GSGG) crystal development. Final report, 1 May-31 December 1984 (Nd:Cr:GSGG), 11:11757 (R;US)
Performance
Laser-illuminated nano-second microscope, 11:11754 (J;US)
SOLID WASTES
See also WOOD WASTES
Leaching
Batch and column extraction procedures for organics in solid wastes, 11:11480 (J;US)
Waste Disposal
Gasification, 11:10736 (RA;US)
Water Pollution Control
Batch and column extraction procedures for organics in solid wastes, 11:11480 (J;US)
SOLIDS
Chemical Reactions
Analytical solution for a first-order reaction in a packed bed with diffusion, 11:11665 (J;US)
Time-resolved Auger electron spectroscopy combined with modulated molecular beam techniques for gas-surface reaction kinetics studies, 11:11662 (J;NL)
Crystal Structure
Molecular dynamics studies of structural transformation in solids, 11:11549 (J;CH)
Diffusion
Monte Carlo calculation of correlation and vacancy wind effects in diffusion, 11:11550 (J;CH)
SOLVENT EXTRACTION
Efficiency
Competitive solvent extraction of alkaline-earth cations into chloroform by lipophilic acyclic diionizable polyethers, 11:11627 (J;US)
Specificity
Competitive solvent extraction of alkaline-earth cations into chloroform by lipophilic acyclic diionizable polyethers, 11:11627 (J;US)
SOLVENT-REFINED COAL PROCESS
See SRC PROCESS
SOLVENT-REFINING COAL PLANTS
See COAL PREPARATION PLANTS
SRC PROCESS
SOUND
See SOUND WAVES
SOUND WAVES
See also ULTRASONIC WAVES
Attenuation
Observation of a collective mode in superconducting UBe_{13}, 11:11536 (J;US)
SOURCE TERMS
How reliable does the waste package containment have to be, 11:11036 (RA;US)
Importance of the source term for the release of radionuclides from a repository in a salt dome, 11:11062 (RA;US)
Quantification of source-term profiles from near-field geochemical models, 11:11065 (RA;US)
Release mechanisms and their role in the spent fuel repository perfomance, 11:11037 (RA;US)
Source-term considerations for a potential radioactive-waste repository located in unsaturated tuff, 11:11064 (RA;US)
Bench-Scale Experiments
Laboratory experiments designed to provide limits on the radionuclide source term for the NNWSI project, 11:11069 (RA;US)
Computerized Simulation
Initial results for the experimental evaluation of a nuclear waste repository source term model, 11:11048 (J;US)
Evaluation
Conceptual model for repository source-term evaluation, 11:11066 (RA;US)
Mathematical Models
Source term modelling in the Swedish KBS - 3 study, 11:11063 (RA;US)
Meetings
Workshop on the source term for radionuclide migration from high-level waste or spent nuclear fuel under realistic repository conditions: proceedings, 11:11061 (R;US)
SOUTH ATLANTIC BIGHT
Air-Water Interactions
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, 1 December 1984-30 November 1985, 11:11859 (R;US)
Research Programs
Coordination: Southeast continental shelf studies. Progress report, 1 June 1984-31 December 1985, 11:12034 (R;US)
Water Currents
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, 1 Dec 1984-30 November 1985, 11:11905 (R;US)
SOUTH KOREA
See REPUBLIC OF KOREA
SPACE HVAC SYSTEMS
Heating, ventilation, and air conditioning systems.

Computerized Control Systems
Micro-computer control VS 1000, 11:11441 (RA;DE;In German)
Economics
Influence of the way the process is carried out on the economic efficiency of indoor air conditioning equipment - a practice report, 11:11434 (RA;DE;In German)
Energy Efficiency
Economics of efficiency improvements in residential appliances and space conditioning equipment, 11:11455 (J;US)
Energy sources: conservation and renewables, 11:11450 (B;US)
Planning
Influence of the way the process is carried out on the economic efficiency of indoor air conditioning equipment - a practice report, 11:11434 (RA;DE;In German)

SPACECRAFT POWER SUPPLIES
Stirling Engines
Overview of free-piston Stirling technology at the NASA Lewis Research Center, 11:11491 (R;US)

SPALLATION
Nuclear Models
Experimental nuclear and radiochemistry. Progress report and review, 1984, 11:12277 (R;US)

SPECTROMETERS
See also NEUTRON SPECTROMETERS
X-RAY SPECTROMETERS
Operation
Curved crystal spectrometer of Johansson type, 11:11804 (RA;SU;In Russian)

SPENT FUEL ELEMENTS
Fuel-Cladding Interactions
Behavior of breached light water reactor spent fuel rods in air and inert atmospheres at 229°C, 11:11047 (J;US)

SPENT FUEL STORAGE
See also DRY STORAGE
MONITORED RETRIEVABLE STORAGE
Implementation
Implementation plan for deployment of Federal Interim Storage facilities for commercial spent nuclear fuel, 11:10990 (R;US)

SPENT FUELS
Forecasting
Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1, 11:11005 (R;US)
Inventories
Spent fuel and radioactive waste inventories, projections, and characteristics. Revision 1, 11:11005 (R;US)
Leaching
Potential effect of water influx on the dissolution rate of UO_2 in spent fuel at the Yucca Mountain, Nevada site, 11:11559 (R;US)
Packaging
Effect of alpha and gamma radiation on the near-field chemistry and geochemistry of high-level waste packages, 11:11031 (R;US)
Purex Process
French experience and prospects in the reprocessing of fast breeder reactor fuels, 11:10985 (R;FR;In French)
Quantitative Chemical Analysis
ISPO Task A-126: application of mixed internal standards to the mass spectrometric analysis of plutonium and uranium in spent fuel dissolver solutions: ORNL results, 11:11721 (R;US)
Radioactive Waste Disposal
Effect of alpha and gamma radiation on the near-field chemistry and geochemistry of high-level waste packages, 11:11031 (R;US)
Spent fuel performance in geologic repository environments, 11:11029 (R;US)
Reprocessing
Spent fuel reprocessing past experience and future prospects, 11:10986 (R;FR;In French)

SPENT LIQUORS
Ultrafiltration
Ultrafiltration of Kraft Black Liquor. Final report, Phase I, 11:11476 (R;US)

SPENT SHALES
Activation Analysis
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)
Quantitative Chemical Analysis
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)

SPHEROMAK DEVICES
Flute Instability
Dynamics and fluctuation spectra of electrostatic resistive interchange turbulence, 11:12437 (R;US)
Transformers
Amplification of S-1 Spheromak current by an inductive current transformer, 11:12499 (R;US)

SPRAY PONDS
See SPRAYS

SPRAYS
Combustion
Multiple ignition, combustion, and quenching of hydrocarbon fuel sprays. Annual report, July 1983-July 1984, 11:11729 (R;US)

SPUTTERING
Excitation
Mechanisms of excitation and ionization processes in sputtering. Final report, 1 September 1981-28 February 1985, 11:12060 (R;US)
Ionization
Mechanisms of excitation and ionization processes in sputtering. Final report, 1 September 1981-28 February 1985, 11:12060 (R;US)

SQUID DEVICES
Superconducting Quantum Interference Devices
Equivalent Circuits
Measurements of the dynamic input impedance of a dc SQUID, 11:11751 (J;US)
Gain
Signal and noise theory for a dc SQUID amplifier, 11:11750 (J;US)
Impedance
Measurements of the dynamic input impedance of a dc SQUID, 11:11751 (J;US)
Noise
Measurements of the dynamic input impedance of a dc SQUID, 11:11751 (J;US)
Signal and noise theory for a dc SQUID amplifier, 11:11750 (J;US)
Optimization
dc SQUIDs as radiofrequency amplifiers, 11:11752 (J;US)

SRC PROCESS
Chemical Effluents
Comparative biology and chemistry of boiling point fractions from different coal liquefaction processes, 11:10927 (R;US)

SRC-II PROCESS
Chemical Effluents
Comparative biology and chemistry of boiling point fractions from different coal liquefaction processes, 11:10927 (R;US)

SRM
See CALIBRATION STANDARDS

STABLE ISOTOPES
For specific terms, consult the Appendix.
See also BARIUM 132
BARIUM 134
BARIUM 136
BARIUM 138
CADMIUM 108
CARBON 12
CARBON 13
DEUTERIUM
GADOLINIUM 155
GERMANIUM 76
HELIUM 3
IRIDIUM 191
IRON 56
IRON 57
LITHIUM 6
MAGNESIUM 24
MAGNESIUM 26
MOLYBDENUM 100

NITROGEN 15
TELLURIUM 122
YTTERBIUM 171
ZIRCONIUM 90
ZIRCONIUM 96

Inventories
Stable isotope inventory requirements and enrichment capabilities, 11:11113 (R;US)

Sales
Stable isotope inventory requirements and enrichment capabilities, 11:11113 (R;US)

STAINLESS STEEL-304
Mechanical Properties
Measurement and prediction of sensitization development in austenitic stainless steels, 11:11526 (R;US)

Thermomechanical Treatments
Measurement and prediction of sensitization development in austenitic stainless steels, 11:11526 (R;US)

STAINLESS STEEL-316
Corrosion
Hydraulics data and materials performance from phase I testing of coal water mixtures, 11:10795 (RA;US)

Deformation
Summary of recent research on mechanical behavior of polycrystalline solids. Progress report, March 1985-March 1986, 11:11512 (R;US)

Erosion
Hydraulics data and materials performance from phase I testing of coal water mixtures, 11:10795 (RA;US)

Hydrogen Embrittlement
Effects of helium content of microstructural development in Type 316 stainless steel under neutron irradiation, 11:11525 (R;US)

Lifetime
Effects of irradiation and high heat flux on the lifetime performance of ferritic and 316 stainless steels, 11:11530 (R;US)

Mechanical Properties
Effects of irradiation and high heat flux on the lifetime performance of ferritic and 316 stainless steels, 11:11530 (R;US)
Measurement and prediction of sensitization development in austenitic stainless steels, 11:11526 (R;US)

Performance Testing
Effects of irradiation and high heat flux on the lifetime performance of ferritic and 316 stainless steels, 11:11530 (R;US)

Radiation Effects
Effects of helium content of microstructural development in Type 316 stainless steel under neutron irradiation, 11:11525 (R;US)

Thermomechanical Treatments
Measurement and prediction of sensitization development in austenitic stainless steels, 11:11526 (R;US)

STAINLESS STEEL-347
Stress Corrosion
BWR pipe crack and weld clad overlay studies, 11:11231 (R;US)

STAINLESS STEELS
See also STAINLESS STEEL-304
STAINLESS STEEL-316
STAINLESS STEEL-347

Fracture Properties
Precipitate formation in austenitic stainless steel welds, 11:11545 (J;US)

Physical Radiation Effects
Effects of rapidly pulsed ion bombardment on microstructure and phase stability in a Ti-modified stainless steel, 11:11509 (R;US)

STANDARD REFERENCE MATERIALS
See CALIBRATION STANDARDS

STANDING CROP
See BIOMASS

STAPHYLOCOCCUS
Delayed Radiation Effects
Recovery of aerobic and anaerobic bacteria from irradiated mice, 11:11990 (R;US)

STARCH
Fermentation
Recombinant genetic approaches for efficient ethanol production, 11:11145 (BA;US)

STARCH GUM
See DEXTRIN

STARS
Astrophysics
Astrophysics. Volume 1. Stars (Text book), 11:12049 (B;US)

Gravitational Collapse
Expanding vortex site for the r-process in rotating stellar collapse, 11:12048 (J;US)

Weak Interactions
Stellar weak interaction rates: the issue of quenching, 11:12360 (R;US)

STATE BUILDINGS
See PUBLIC BUILDINGS

STATIC RESERVOIR PRESSURE
See RESERVOIR PRESSURE

STEAM CONDENSERS
Failures
Seminar proceedings: prevention of condenser failures - the state of the art, 11:11215 (R;US)

STEAM GENERATION PLANTS
Economic Analysis
Feasibility of wet oxidation for combustion of coal slurries, 11:10878 (RA;US)

Planning
Planning waste-to-energy plants in Puerto Rico, 11:11146 (RA;PR)

STEAM GENERATORS
Heat Exchangers
Heat flux limiting sleeves, 11:11259 (P;US)

STEAM TURBINES
Fatigue
Steam turbines and reliability, 11:11245 (RA;CS;In Czech)

Reliability
Steam turbines and reliability, 11:11245 (RA;CS;In Czech)

STEELS
See also AUSTENITIC STEELS
CARBON STEELS
FERRITIC STEELS
STAINLESS STEELS

Mechanical Properties
Review of the models and mechanisms for environmentally-assisted crack growth of pressure vessel and piping steels in PWR environments, 11:11524 (R;US)

STELLARATORS
ECR Heating
Review of electron cyclotron heating experiments in toroidal devices, 11:12439 (R;US)

Electron Plasma Waves
Review of electron cyclotron heating experiments in toroidal devices, 11:12439 (R;US)

Flute Instability
Dynamics and fluctuation spectra of electrostatic resistive interchange turbulence, 11:12437 (R;US)

Plasma Confinement
Review of electron cyclotron heating experiments in toroidal devices, 11:12439 (R;US)

STEM (PLANT)
See PLANT STEMS

STILBENE
Chemical Preparation
New method of synthesizing stilbene compounds with heterocyclic substituents, anil synthesis, 11:11698 (TJ;US)

STILLAGE
Materials Recovery
Grain sorghum stillage processing: nutrient recovery and pollution control, 11:11134 (RA;PR)

Waste Processing
Grain sorghum stillage processing: nutrient recovery and pollution control, 11:11134 (RA;PR)

STIMULATED EMISSION DEVICES
See LASERS

STIRLING ENGINES
Ceramics
Ceramic Automotive Stirling Engine study, 11:11490 (R;US)
Materials Testing
Creep-rupture behavior of iron superalloys in high-pressure hydrogen, 11:11516 (R;US)
Creep rupture behavior of Stirling engine materials (Iron-base NASAUT 4G-Al), 11:11517 (R;US)
Performance Testing
Evaluation of alternate-fuels performance in an external combustion system. Final report, 11:11489 (R;US)
Research Programs
Overview of free-piston Stirling technology at the NASA Lewis Research Center, 11:11491 (R;US)
Stirling engine supporting research and technology, 11:11492 (R;US)
STORAGE BATTERIES
See ELECTRIC BATTERIES
STORAGE BATTERIES (LEAD-ACID)
See LEAD-ACID BATTERIES
STORAGE FACILITIES
Engineering
Design considerations for coal-water slurry handling systems at utility and industrial plants, 11:10835 (RA;US)
STORAGE RINGS
See also DCI ORSAY STORAGE RING
HERA STORAGE RING
LEP STORAGE RINGS
SUPERCONDUCTING SUPER COLLIDER
Electron Beams
Resonant depolarization in electron storage rings equipped with "siberia snakes", 11:11811 (R;FR)
Polarized Beams
Resonant depolarization in electron storage rings equipped with "siberia snakes", 11:11811 (R;FR)
Suppresion of beam-beam depolarization, 11:11812 (R;FR)
STORAGE (SPENT FUEL)
See SPENT FUEL STORAGE
STORES
See COMMERCIAL BUILDINGS
STOVER
See AGRICULTURAL WASTES
STRATA CONTROL
Research Programs
Strata control investigations in the Sydney coalfield - Annual report, January 1 to December 31, 1984, 11:10819 (R;CA)
STRATEGIC PETROLEUM RESERVE
Program Management
Strategic Petroleum Reserve: site expansion alternatives to the development of the Big Hill site, 11:10955 (R;US)
Waste Disposal
Field test of drag reducing agents in a three-inch pipeline at the West Hackberry, Louisiana SPR site, 11:10957 (R;US)
STREETS
See ROADS
STRESS (BIOLOGICAL)
See BIOLOGICAL STRESS
STRING MODELS
Treating the interactions of extended particles through breaking and connection of strings.
Equations of Motion
Baryon string model. 1. Canonical formalism and general solution of classical equations of motion for the three-string, 11:12190 (R;SU;In Russian)
Multiple Production
Fragmentation functions for quarks and diquarks in the model of quark-gluon strings, 11:12200 (R;SU)
Three-Body Problem
Baryon string model. 1. Canonical formalism and general solution of classical equations of motion for the three-string, 11:12190 (R;SU;In Russian)
STRONG INTERACTIONS
Muons Minus
Muon catalyzed fusion - fission reactor driven by a recirculating beam, 11:12494 (R;US)
Research Programs
[Theoretical elementary particle studies.] Final report, September 1983-July 1985 , 11:12224 (R;US)
STRONTIUM
Ion Exchange Chromatography
Sodium titanate. A highly selective inorganic ion exchanger for strontium, 11:11020 (RA;XA)
Leaching
Sodium titanate. A highly selective inorganic ion exchanger for strontium, 11:11020 (RA;XA)
STRONTIUM 85
Diffusion
Investigation of siting parameters for near surface disposal of low-level nuclear waste. Final report, 11:11000 (R;US)
STRONTIUM 90
Ground Disposal
Investigation of the effect of waste disposal procedure modifications on disposal of D-2 waste to the ground, 11:11902 (R;US)
Radioecological Concentration
Investigation report of the release of strontium-90 from the Building 3517 cell ventilation improvements construction site on November 29, 1985, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 11:11082 (R;US)
Soil Chemistry
Ground disposal of radioactive wastes at the Hanford site, 11:11901 (R;US)
Translocation
Comparison of predictions from internationally recognized assessment models for the transfer of selected radionuclides through terrestrial food chains, 11:11904 (J;US)
STRONTIUM 97
Nuclear Deformation
Deformation and shape coexistence in medium mass nuclei, 11:12332 (J;NL)
STRONTIUM OXIDES
X-Ray Spectra
Ion-excited K X-ray spectra of oxygen, 11:12076 (RA;US)
STRUCTURAL BUCKLING
See DEFORMATION
STRUCTURAL MATERIALS
See BUILDING MATERIALS
STRUCTURES (BUILDINGS)
See BUILDINGS
STRUCTURES (MECHANICS)
See MECHANICAL STRUCTURES
SUBBITUMINOUS COAL
Research Programs
Preparation, handling, and storage, 11:10851 (RA;US)
SUBSIDENCE (GROUND)
See GROUND SUBSIDENCE
SUBSTRATES
Chemical Preparation
Surface-enhanced Raman spectroscopy: a new tool for chemical detection, 11:11608 (R;US)
Roughness
Surface-enhanced Raman spectroscopy: a new tool for chemical detection, 11:11608 (R;US)
SUBSURFACE ENVIRONMENTS
Meetings
Anaerobic biogeochemical processes in the subsurface. Subsurface transport program, interactive seminar series, 11:11894 (R;US)
SUGAR CANE
Resource Potential
Energy cane alternative, 11:11160 (RA;PR)
SULFIDES
See also CADMIUM SULFIDES
HYDROGEN SULFIDES
SILVER SULFIDES
Chemical Preparation
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_4)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_3$ (μ-S. SO)$_3$]$_3$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Dissociation Energy
Ion model and dipole polarizabilities in energy calculations, 11:11580 (R;IT)

Molecular Structure
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Polarizability
Ion model and dipole polarizabilities in energy calculations, 11:11580 (R;IT)
SULFITE WASTE LIQUOR
See SPENT LIQUORS
SULFITES
Specific compounds should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.
Oxidation
One-electron redox reactions in aqueous solutions of sulfite with hydroquinone and other hydroxyphenols, 11:11683 (J;US)
SULFUR
Retention
Combustion of calcium-exchanged coal. Eighth quarterly report, 11:10905 (R;US)
X-Ray Spectra
Systematics of K X-ray satellite structure excited by heavy-ion impact, 11:12075 (RA;US)
SULFUR 32 REACTIONS
Heavy Ion Fusion Reactions
Fission-like phenomena for systems with mass A=110, 11:12312 (R;FR)
SULFUR 35
Biological Accumulation
Distribution of sulfur in the wheat grain as shown by radioautographs, 11:12014 (J;NL)
Tracer Techniques
Fungal penetration of defensive barriers of plants, 11:11933 (RA;US)
SULFUR COMPOUNDS
See also CARBON OXYSULFIDE
SULFIDES
SULFITES
Ion Collisions
Ultrahigh-resolution studies of heavy-ion induced X-ray satellite emission, 11:12114 (J;NL)
Physical Radiation Effects
Ultrahigh-resolution studies of heavy-ion induced X-ray satellite emission, 11:12114 (J;NL)
SULFUR DIOXIDE
Air Pollution Control
Environmental control technology, 11:11219 (RA;US)
Fluidized bed combustion, 11:10900 (RA;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
Chemical Preparation
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Corrosive Effects
Effect of sulfur sorbent and gas cycling on corrosion of FBC materials at 866 K, 11:10896 (R;US)
Mass Transfer
Gas exchange between the forest and the atmosphere, 11:11866 (R;US)
Molecular Structure
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Natural Occurrence
Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)
Pollution Sources
Comparative evaluation of the effects of acid precipitation, natural acid production, and harvesting on cation removal from forests, 11:11869 (R;US)
Reduction
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Removal
Alternative method for the removal of oxides of nitrogen and sulfur from combustion processes. First quarterly technical status report, September 17-December 31, 1985, 11:10788 (R;US)
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
SULFUR HYDRIDES
See HYDROGEN SULFIDES
SULFUR IONS
Electron-Ion Collisions
Electron collisions with positive ions. Progress report, April 1, 1985-March 31, 1986, 11:12079 (R;US)
SULFUR SULFIDES
See SULFUR
SULF-X PROCESS
Pittsburgh Energy Technology Center quarterly technical progress report for the period ending June 30, 1985, 11:10911 (R;US)
SUN
Star Models
Solar breeder to explain constant luminosity and the lack of neutrinos, 11:12051 (J;US)
SUPERALLOYS
See HEAT RESISTING ALLOYS
SUPERCOMPUTERS
Data-Flow Processing
FASTRUN: a high performance computing device for molecular mechanics using a pipeline architecture, 11:12519 (R;US)
SUPERCONDUCTING CAVITY RESONATORS
Performance Testing
Superconducting tests of beta = 0.1 and beta = 0.2 resonators, 11:11802 (R;US)
SUPERCONDUCTING MAGNETS
Data Acquisition
Implementation and operation of VAX-based data acquisition system for the large coil task, 11:12477 (R;US)
Design
Impact of several reactor features on TF coil design for TPSS, 11:12503 (R;US)
Installation
K500 cyclotron magnet, 11:11795 (RA;US)
Magnetic Fields
Measurement of the magnetic field of the CDF magnet, 11:11821 (R;US)
Power Supplies
Main magnet power supply, 11:11797 (RA;US)
Quenching
Impact of several reactor features on TF coil design for TPSS, 11:12503 (R;US)
Radiation Effects
Impact of several reactor features on TF coil design for TPSS, 11:12503 (R;US)
Research Programs
Development of high field superconductors for fusion energy applications. Progress report, August 1, 1984-January 15, 1985, 11:11514 (R;US)
Development of high field superconductors for fusion energy applications. Progress report, 9/1/83-11/30/83, 11:11515 (R;US)
Stability
Impact of several reactor features on TF coil design for TPSS, 11:12503 (R;US)
Transients
Initial estimate of transmission line effects in SSC Design D magnets, 11:11809 (R;US)
SUPERCONDUCTING QUANTUM INTERFERENCE DEVI
See SQUID DEVICES

SUPERCONDUCTING SUPER COLLIDER
Magnetic Dipoles
6.4 Tesla dipole magnet for the SSC, 11:11805 (R;US)
Superconducting Magnets
Initial estimate of transmission line effects in SSC Design D magnets, 11:11809 (R;US)
Technology Assessment
Report of the HEPAP Subpanel on Advanced Accelerator R and D and the SSC, 11:11784 (R;US)
SUPERCONDUCTORS
Fabrication
Development of high field superconductors for fusion energy applications. Progress report, August 1, 1984-January 15, 1985, 11:11514 (R;US)
Development of high field superconductors for fusion energy applications. Progress report, 9/1/83-11/30/83, 11:11515 (R;US)
Penetration Depth
Magnetic depth profiles by neutron reflection, 11:11508 (R;US)
SUPERCRITICAL FLUID CHROMATOGRAPHY
Efficiency
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
Pressure programming in supercritical fluid chromatography, 11:11631 (J;US)
Supercritical fluid methods for the analysis of complex fuel and environmental samples, 11:11620 (R;US)
Operation
Investigation of retention and selectivity effects using various mobile phases in capillary super critical fluid chromatography, 11:11630 (J;US)
Parametric Analysis
Pressure programming in supercritical fluid chromatography, 11:11631 (J;US)
SUPERFUND
Budgets
Status of EPA's remedial cleanup efforts, 11:11378 (R;US)
SUPERGRAVITY
Coupling
Coupling of Yang-Mills to N=4, d=4 supergravity, 11:12229 (R;IT)
Quantization
Quantization of the fermionic sector in N=1, D=11 supergravity, 11:12241 (R;BR)
Singularity
Anomaly freedom in chiral supergravities (6, 8 and 10 dimensions), 11:12230 (R;IT)
SUPERHETERODYNE RECEIVERS
See HETERODYNE RECEIVERS
SUPERLATTICES
Microstructure
Optical imaging of dislocations in strained-layer superlattices and lattice-mismatched epilayers, 11:11588 (R;US)
SUPERSYMMETRY
Supersymmetry: experimental signatures at hadron colliders, 11:12143 (R;CH)
Gauge Invariance
New gauge for supersymmetric abelian gauge theories, 11:12218 (R;BR)
Grand Unified Theory
Low-energy predictions of a two-loop finite supersymmetric SU_5 theory, 11:12265 (J;NL)
Lattice Field Theory
2-dimensional N=2 Wess-Zumino model on the lattice; from Dirac-Kaehler formalism to the Nicolai mapping, 11:12232 (R;BR)
SUPERVOLTAGE RADIOTHERAPY
See RADIOTHERAPY
SUPPORT PILLARS
Design
Strata control investigations in the Sydney coalfield - Annual report, January 1 to December 31, 1984, 11:10819 (R;CA)
Strains
Stress control technique: its history and suitability for WIPP, 11:11041 (R;US)
Stresses
Stress control technique: its history and suitability for WIPP, 11:11041 (R;US)
SUPPORTS
Design
Empirical methods of support design for the Sydney coalfield, 11:10820 (R;CA)
Static Loads
Recognizing signs of excessive loading in underground coal mines. Information Circular/1985, 11:10925 (R;US)
SURFACE EXPLOSIONS
Radioactive Wastes
Radiological water decontamination study, 11:11918 (R;US)
SURFACE MINING
Economic Analysis
Factors affecting the rent to surface-mined coal tracts in the Powder River Basin and Green River/Hams Fork Region, 11:10918 (R;US)
Mathematical Models
Factors affecting the rent to surface-mined coal tracts in the Powder River Basin and Green River/Hams Fork Region, 11:10918 (R;US)
SURFACE WATERS
See also COASTAL WATERS
LAKES
PONDS
SEAS
Radiation Monitoring
Environmental Radiation Data report 30, April-June 1982. Quarterly report, 11:11885 (R;US)
Environmental Radiation Data report 29: January-March 1982, 11:11883 (R;US)
Environmental Radiation Data report 28: October-December 1981, 11:11884 (R;US)
SURFACE-ACTIVE AGENTS
See SURFACTANTS
SURFACES
Electron Spin Resonance
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
Ion Collisions
Mechanisms of excitation and ionization processes in sputtering. Final report, 1 September 1981-28 February 1985, 11:12060 (R;US)
Sorptive Properties
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
SURFACTANTS
Performance
Slurry characteristics of CWS with Highcoal F-3225 in pilot scale production test (Coal water slurry), 11:10839 (RA;US)
SURRY POWER STATION UNIT-1
See SURRY-1 REACTOR
SURRY POWER STATION UNIT-2
See SURRY-2 REACTOR
SURRY-1 REACTOR
Gravel Neck, Virginia, USA
Steam Generators
Surry steam generator - examination and evaluation, 11:11256 (R;US)
SURRY-2 REACTOR
Gravel Neck, Virginia, USA
Steam Generators
Surry steam generator - examination and evaluation, 11:11256 (R;US)
SURRY-3 REACTOR
Gravel Neck, Virginia, USA
Steam Generators
Surry steam generator - examination and evaluation, 11:11256 (R;US)
SURRY-4 REACTOR
Gravel neck, Virginia, USA
Steam Generators
Surry steam generator - examination and evaluation, 11:11256 (R;US)
SUSPENSIONS (FUEL)
See FUEL SLURRIES

SWEDEN
Coal Preparation Plants
Flexible approach to expanding production capacity for Nycol, 11:10842 (RA;US)
Fluid Carbon fuel production and utilization in Sweden, 11:10840 (RA;US)
Geochemistry
Stripa project quarterly report. October through December 1984, 11:11023 (R;SE)
SWEEP EFFICIENCY
Comparative Evaluations
Sweep efficiency model for underground coal gasification, 11:10769 (RA;US)
Field Tests
Sweep efficiency model for underground coal gasification, 11:10769 (RA;US)
Mathematical Models
Sweep efficiency model for underground coal gasification, 11:10769 (RA;US)
SWITCHING CIRCUITS
Design
Temperature dependent electron transport studies for diffuse discharge switching applications, 11:11770 (R;US)
Temperature Dependence
Temperature dependent electron transport studies for diffuse discharge switching applications, 11:11770 (R;US)
SYMPOSIA
See MEETINGS
SYNCHROTRON RADIATION SOURCES
See also NSLS
Recommendations
Major facilities for materials research and related disciplines. Final report, 11:11118 (R;US)
SYNROC
See SYNTHETIC ROCKS
SYNTHESIS GAS
Consumption Rates
LRC liquefaction reducing gas composition and moisture effects product yield, quality and operability, 11:10740 (RA;US)
SYNTHETASES
See LIGASES
SYNTHETIC FUELS
See also ALCOHOL FUELS
Chemical Properties
WIDCO Partial Seam CRIP test: impact of gas characteristics on processing requirements, 11:10750 (RA;US)
Cost
Critical economic parameters for underground coal gasification, 11:10916 (RA;US)
Economic Analysis
UCG - derived synthesis gas: an economic comparison, 11:10758 (RA;US)
Gas Chromatography
Aspects of high-resolution gas chromatography as applied to the analysis of hydrocarbon fuels and other complex organic mixtures. Volume 2. Survey of sample-insertion techniques. Final report, January-September 1980, 11:11603 (R;US)
Marketing Research
Critical economic parameters for underground coal gasification, 11:10916 (RA;US)
Microemulsions
Stability and composition of palm, coconut and soy oil fatty acid microemulsion diesel fuels, 11:11499 (R;US)
Physical Properties
WIDCO Partial Seam CRIP test: impact of gas characteristics on processing requirements, 11:10750 (RA;US)
Research Programs
Synthetic Fuel Center operation. Monthly progress report No. 2, 1-31 December 1985, 11:11502 (R;US)
SYNTHETIC FUELS REFINERIES
Chemical Effluents
Guidance document for prioritizing supplemental monitoring around synfuels facilities, 11:10922 (R;US)
SYNTHETIC NATURAL GAS
See HIGH BTU GAS
SYNTHETIC ROCKS
Bulk Density
Uniaxial and triaxial compression test series on two types of foundry stone, 11:11038 (R;US)
Compression Strength
Uniaxial and triaxial compression test series on two types of foundry stone, 11:11038 (R;US)
Mechanical Tests
Uniaxial and triaxial compression test series on two types of foundry stone, 11:11038 (R;US)
SYNTHINE PROCESS
See FISCHER-TROPSCH SYNTHESIS

T

T MATRIX
See S MATRIX
TANDEM MIRROR DEVICES
See TMX DEVICES
TANDEM MIRRORS
Prior to September 1983 this concept was indexed to TMX DEVICES.
See also TMX DEVICES
Charged-Particle Transport
Monte Carlo particle simulation and finite-element techniques for tandem mirror transport, 11:12456 (R;US)
Dispersion Relations
Destabilization of MHD modes with finite Larmor radius effects in tandem mirrors, 11:12438 (R;US)
ICR Heating
Confinement by axisymmetric mirror configuration. Quarterly progress in STM program, July-September 1985, 11:12431 (R;US)
Magnetohydrodynamics
Destabilization of MHD modes with finite Larmor radius effects in tandem mirrors, 11:12438 (R;US)
Plasma Confinement
Confinement by axisymmetric mirror configuration. Quarterly progress in STM program, July-September 1985, 11:12431 (R;US)
Plasma Instability
Confinement by axisymmetric mirror configuration. Quarterly progress in STM program, July-September 1985, 11:12431 (R;US)
TANK FARMS
See STORAGE FACILITIES
TANKS
Calibration
The analysis of tank calibration data from several runs, 11:11100 (J;US)
Mechanical Vibrations
Analytical and experimental comparisons of modal properties of a flood water storage tank, 11:11303 (R;US)
Nuclear Materials Management
The analysis of tank calibration data from several runs, 11:11100 (J;US)
Response Functions
Analytical and experimental comparisons of modal properties of a flood water storage tank, 11:11303 (R;US)
TANTALATES
Specific compounds should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.
Ion Channeling
Ion channeling studies of $KTaO_3$:Nb, 11:11562 (J;GB)
TANTALUM
Electrochemistry
Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)
Stability
Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)

TANTALUM 181 TARGET
Carbon 12 Reactions
Fast neutron emission in interaction of 9 MeV/nucleon ^{12}C and ^{20}Ne ions with ^{181}Ta nuclei, 11:12338 (R;SU;In Russian)
Electron Reactions
Photoneutron cross sections, 11:12334 (R;BR)
Neon 20 Reactions
Fast neutron emission in interaction of 9 MeV/nucleon ^{12}C and ^{20}Ne ions with ^{181}Ta nuclei, 11:12338 (R;SU;In Russian)
Photonuclear Reactions
Photoneutron cross sections, 11:12334 (R;BR)
TARGET CHAMBERS
Uses
Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 11:12308 (J;NL)
TEA
See BEVERAGES
TECHNETIUM
Radionuclide Migration
Source term modelling in the Swedish KBS - 3 study, 11:11063 (RA;US)
TECHNETIUM 99
Isotope Production
Zirconium molybdate gel as a generator for technetium-99m, 11:11716 (R;AU)
TELLURATES
Specific compounds should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.
Chemical Radiation Effects
Effect of gamma radiation on various inorganic ion exchangers, 11:11712 (RA;XA)
TELLURIUM 122
Moment of Inertia
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
Rotational States
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
TELLURIUM ISOTOPES
See also TELLURIUM 122
Decay
Report on CFRMF fission product loop study, 11:12329 (R;US)
TEMPERATURE (AMBIENT)
See AMBIENT TEMPERATURE
TERBIUM 157
Electron Capture Decay
Atomic L-subshell yields from the electron capture decays of $_{65}157$Tb and $_{65}^{158}$Tb, 11:12333 (R;AU)
TERBIUM 158
Electron Capture Decay
Atomic L-subshell yields from the electron capture decays of $_{65}^{157}$Tb and $_{65}^{158}$Tb, 11:12333 (R;AU)
TERRESTRIAL ECOSYSTEMS
Food Chains
Comparison of predictions from internationally recognized assessment models for the transfer of selected radionuclides through terrestrial food chains, 11:11904 (J;US)
Structural Models
Linkages in hierarchical models, 11:11893 (R;US)
TEST PARTICLES
Energy Levels
Generalized Euler's formula from Poisson's summation formula and some applications, 11:12412 (R;BR)
Equations of Motion
Generalized Euler's formula from Poisson's summation formula and some applications, 11:12412 (R;BR)
TETRAHYDRONAPHTHALENE
See TETRALIN
TETRALIN
Comparative Evaluations
Enhanced coal liquefaction with ammonia and amines in single and binary solvent systems. Seventh quarterly report, April 1-June 30, 1985, 11:10780 (R;US)
Hydrogenation
Hydrotreatment catalyst activity enhancement. Quarterly report No. 9, August 1-October 31, 1985, 11:10782 (R;US)
TETRAMETHYLTETRASELENAFULVALENE
See TMTSF
TEXACO GASIFICATION PROCESS
Comparative Evaluations
Surface gasification data system: feasibility studies overview report, 11:10778 (R;US)
TEXAS
Radioactive Waste Disposal
Managing the nation's nuclear waste. Site descriptions: Cypress Creek, Davis Canyon, Deaf Smith, Hanford Reference, Lavender Canyon, Richton Dome, Swisher, Vacherie Dome, and Yucca Mountain, 11:11007 (R;US)
TEXAS A AND M CYCLOTRON
Beam Monitors
Proton beam position and intensity monitors, 11:11787 (RA;US)
Computers
Computer systems, 11:11796 (RA;US)
Control Systems
Computer aided design, 11:11801 (RA;US)
Cyclotron control system, 11:12069 (RA;US)
Dees
Study of the dee-to-dee shielding, 11:11785 (RA;US)
Helium Dilution Refrigerators
K500 cyclotron magnet, 11:11795 (RA;US)
Magnet Coils
K500 cyclotron magnet, 11:11795 (RA;US)
Trim coil power supplies, 11:11798 (RA;US)
NaI Detectors
Efficiency and response of the total energy counter, 11:11819 (RA;US)
Operation
Statistics of cyclotron operation, 11:11786 (RA;US)
Plastic Scintillation Detectors
Parity violation in ^{3}H (vector p/sub e/, p) H scattering, 11:11820 (RA;US)
RF Systems
K500 RF power supply, 11:11799 (RA;US)
K500 RF system, 11:11800 (RA;US)
Secondary Emission Detectors
Microchannel plate zero time detector, 11:11818 (RA;US)
Superconducting Magnets
K500 cyclotron magnet, 11:11795 (RA;US)
Main magnet power supply, 11:11797 (RA;US)
TEXTILE INDUSTRY
Load Management
Analysis of a customer-side-of-the-meter storage battery facility, 11:11218 (R;US)
TEXTOR TOKAMAK
Wall Effects
Accelerator-based plasma-wall interaction studies on the TEXTOR tokamak, 11:12470 (J;NL)
TFTR DEVICE
See TFTR TOKAMAK
TFTR REACTORS
See TFTR TOKAMAK
TFTR TOKAMAK
Beam Injection Heating
Neutral beam heating system for the tokamak fusion test reactor, 11:12511 (J;NL)
Beam Transport
Neutral beam heating system for the tokamak fusion test reactor, 11:12511 (J;NL)
THERMAL CONDUCTIVITY
Measuring Methods
Thermal conductivities of Wilsonville solvent and Wilsonville solvent/Illinois No. 6 coal slurry, 11:10791 (R;US)
THERMAL ENERGY STORAGE EQUIPMENT
High temperature composite thermal storage systems for industrial applications, 11:11360 (R;US)
THERMAL ENVELOPE HOUSES
See DOUBLE ENVELOPE BUILDINGS
THERMAL INSULATION
Emission
Formaldehyde emissions from fibrous glass insulation products, 11:11865 (R;US)

THERMAL MASS
Parametric Analysis
Statistically based parametric analysis of exterior envelope thermal mass effect predictions, 11:11417 (R;US)
THERMAL POLLUTION (AIR)
See AIR POLLUTION
THERMAL POLLUTION (WATER)
See WATER POLLUTION
THERMODYNAMIC CYCLES
Computerized Simulation
Computer simulation of the turbo-charged turbocompounded diesel engine system: a description of the thermodynamic and heat transfer models, 11:11487 (R;US)
THERMOLUMINESCENT DOSEMETERS
Sensitivity
Characteristics of some TLDs for low dose measurement, 11:11825 (RA;AT)
Specifications
Characteristics of some TLDs for low dose measurement, 11:11825 (RA;AT)
THERMOLUMINESCENT DOSIMETRY
Mathematical Models
Relative standard deviation of thermoluminescence dosimetry - comparison of the experiments with theory, 11:11826 (RA;AT)
THERMONUCLEAR REACTOR MATERIALS
Crack Propagation
Effects of radiation and high heat flux on the performance of first-wall components. Final report, 11:12491 (R;US)
Hydrogen Embrittlement
Effects of radiation and high heat flux on the performance of first-wall components. Final report, 11:12491 (R;US)
Mechanical Properties
Effects of irradiation and high heat flux on the lifetime performance of ferritic and 316 stainless steels, 11:11530 (R;US)
Perspective on present and future alloy development efforts on austenitic stainless steels for fusion application, 11:11507 (R;US)
Physical Radiation Effects
Effects of radiation and high heat flux on the performance of first-wall components. Final report, 11:12491 (R;US)
Thermal Fatigue
Effects of radiation and high heat flux on the performance of first-wall components. Final report, 11:12491 (R;US)
THERMONUCLEAR REACTOR WALLS
See also FIRST WALL
Testing
ORNL facilities for testing first-wall components, 11:12479 (R;US)
THERMONUCLEAR REACTORS
For use in cases where certain aspects of either hypothetical or real thermonuclear reactors are discussed.
See also LASER FUSION REACTORS
TOKAMAK TYPE REACTORS
Fusion reactor physics and technology studies. Final report, October 1, 1977-November 30, 1985, 11:12493 (R;US)
Computer Codes
FORIG: a computer code for calculating radionuclide generation and depletion in fusion and fission reactors. User's manual, 11:12506 (R;US)
THERMONUCLEAR WEAPONS
See NUCLEAR WEAPONS
THIN FILMS
Decomposition
LLE Review. Quarterly report, April-June 1985, 11:12488 (R;US)
Surface Properties
Ultra high vacuum electrochemistry with conducting polymers, 11:11701 (J;GB)
THIO COMPOUNDS
See ORGANIC SULFUR COMPOUNDS
THIOETHERS
See SULFIDES
THIONYL CHLORIDES
Electrochemistry
Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)
THIOPHENE
Desulfurization
Adsorption and desulfurization of thiophene on nickel(111), 11:11670 (R;US)
Sorptive Properties
Adsorption and desulfurization of thiophene on nickel(111), 11:11670 (R;US)
THORIUM
Diffusion
Experimentation and modelling of U, Th, and lanthanides transport in fissured rocks. Influence of complexation, 11:11057 (R;FR)
Extraction Chromatography
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinide elements, 11:11613 (RA;XA)
Ion Exchange Chromatography
Ion exchange characteristics of hydrous oxides and their use in the separation of uranium and thorium, 11:11612 (RA;XA)
Photometry
High precision spectrophotometric analysis of thorium, 11:11618 (R;BR;In Portuguese)
Radiochemical Analysis
Techniques of sample attack used in soil and mineral analysis. Phase I, 11:11614 (R;CA)
Spectrophotometry
High precision spectrophotometric analysis of thorium, 11:11618 (R;BR;In Portuguese)
THORIUM 232
Delayed Neutron Analysis
Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel, 11:11108 (J;US)
Photofission
High resolution studies of photofission of ^{233}Th and ^{230}U, 11:12349 (R;US)
Radiation Monitoring
Radioactive substances in building materials. A compilation of results from samples examined at SSI, 11:12392 (R;SE;In Swedish)
THORIUM 232 TARGET
Intermediate Structure
High resolution photofission measurements in ^{235}U and ^{232}Th. Final report (5.8 to 12 MeV), 11:12350 (R;US)
Photofission
High resolution photofission measurements in ^{238}U and ^{232}Th. Final report (5.8 to 12 MeV), 11:12350 (R;US)
THORIUM PHOSPHATES
Chemical Preparation
Synthesis and characterization of crystalline phosphate of thorium, uranium and neptunium, 11:11725 (J;CH)
Quantitative Chemical Analysis
Synthesis and characterization of crystalline phosphate of thorium, uranium and neptunium, 11:11725 (J;CH)
THREE MILE ISLAND-2 REACTOR
Dauphin County, Pennsylvania, USA
Electrical Equipment
Passive surveillance: a technique to characterize the condition of power and control circuits in a nuclear plant, 11:11304 (R;US)
Fission Products
TMI-2 isotopic inventory calculations, 11:11241 (R;US)
Fuel Rods
SOURCES calculation of TMI-2 spontaneous-fission and (α,n) neutron sources, 11:11254 (RA;US)
Low-Level Radioactive Wastes
Low level waste data base development - EPICOR-II resin/liner investigation. Program review, 11:11013 (R;US)
Radioactivity
SOURCES calculation of TMI-2 spontaneous-fission and (α,n) neutron sources, 11:11254 (RA;US)
Reactor Cores
TMI-2 isotopic inventory calculations, 11:11241 (R;US)
Reactor Dismantling
Case of Three Mile Island (Reactor dismantling and decontamination), 11:11242 (R;BE;In French)

TIME PROJECTION CHAMBERS
See PROJECTION SPARK CHAMBERS
TIME-OF-FLIGHT METHOD
Data Acquisition
FASTBUS data acquisition system for neutron time-of-flight measurements, 11:12387 (J;US)
TIN
Catalytic Effects
Trifunctional catalysts for conversion of syngas to alcohols. Fifth quarterly report, September 1-November 30, 1985, 11:11141 (R;US)
TIN 108
Doppler Effect
Measurement of the ionization probability of the 1s sigma molecular orbital in half a collision at zero impact parameter, 11:12317 (R;FR)
Ionization
Measurement of the ionization probability of the 1s sigma molecular orbital in half a collision at zero impact parameter, 11:12317 (R;FR)
TIN ALLOYS
Chemical Composition
Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
Critical Field
Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
Lattice Parameters
Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
Moessbauer Effect
Mossbauer studies on LaNi(4.7)Sn(0.3) and its hydride, 11:11411 (R;US)
Superconductivity
Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
Transition Temperature
Superconducting critical temperatures, critical magnetic fields, lattice parameters, and chemical compositions of "bulk" pure and alloyed Nb_3Sn produced by the bronze process, 11:11531 (J;US)
TIN OXIDES
Surface Coating
Indium tin oxide/gallium arsenide solar cells, 11:11171 (J;US)
TISSUE CULTURES
Exposure Chambers
Two-dimensional diffusion limited system for cell growth, 11:11985 (R;US)
TISSUES
Quantitative Chemical Analysis
Microanalytical techniques for boron analysis using the $^{10}B(n,\alpha)^7Li$ reaction, 11:11981 (J;US)
TITANATES
Specific compounds, except those of significance to energy research and development, should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.
Solid Solutions
Substantial solid solutions of bismuth-containing lanthanide dititanates, Ln/sub 2-x/Bi/sub x/Ti_2O_7, 11:11564 (J;US)
TITANIUM
Hydridation
Capabilities of light element surface analysis by nuclear microanalysis, 11:11617 (R;FR;In French)
Ion Scattering Analysis
Capabilities of light element surface analysis by nuclear microanalysis, 11:11617 (R;FR;In French)
Radiation Scattering Analysis
Capabilities of light element surface analysis by nuclear microanalysis, 11:11617 (R;FR;In French)
Removal
Two-stage liquefaction catalyst evaluation. Final report, 11:10789 (R;US)
Sorptive Properties
ESR studies of surface adsorption and catalysis under ultra-high vacuum conditions. Final report, 11:11642 (R;US)
TITANIUM 50 TARGET
Argon 40 Reactions
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
TITANIUM ALLOYS
Hydridation
Irreversible effects in the FeTi-H system, 11:11567 (J;CH)
Mechanical Properties
Perspective on present and future alloy development efforts on austenitic stainless steels for fusion application, 11:11507 (R;US)
Physical Radiation Effects
Amorphous phase transition in irradiated NiTi alloy (Electron irradiation and Ni and Ta ion irradiation), 11:11539 (J;GB)
TITANIUM BROMIDES
Chemical Preparation
Synthesis of submicron titanium diboride powders, 11:11658 (J;US)
TITANIUM CARBIDES
Phase Studies
Binary and ternary amorphous alloys of ion-implanted Fe-Ti-C, 11:11527 (R;US)
TITANIUM HYDRIDES
Adsorption Isotherms
Irreversible effects in the FeTi-H system, 11:11567 (J;CH)
Catalytic Effects
Direct coal liquefaction using iron-titanium hydride as a hydrogen distribution and catalytic material. Progress report No. 5, September 1-November 30, 1985, 11:10786 (R;US)
Phase Studies
Irreversible effects in the FeTi-H system, 11:11567 (J;CH)
TITANIUM OXIDES
Phase Studies
Analytical electron microscopy studies of precipitation in ceramic systems, 11:11558 (R;US)
Photochemical Reactions
Moessbauer study of the kinetics of Fe^{3+} photoreduction on TiO_2 semiconductor powders, 11:11704 (J;US)
Reduction
Metal-support effects on H_2 and CO heats of adsorption on TiO_2-supported platinum, 11:11654 (J;US)
Sorptive Properties
Metal-support effects on H_2 and CO heats of adsorption on TiO_2-supported platinum, 11:11654 (J;US)
TITANIUM PHOSPHATES
Chemical Radiation Effects
Effect of gamma radiation on various inorganic ion exchangers, 11:11712 (RA;XA)
TLD (DOSEMETERS)
See THERMOLUMINESCENT DOSEMETERS
TLD (DOSIMETRY)
See THERMOLUMINESCENT DOSIMETRY
TLD SYSTEMS
See THERMOLUMINESCENT DOSEMETERS
TMPN
See ORGANIC OXYGEN COMPOUNDS
TMTSF
Magnetic Properties
Magnetic order in the TMTSF family of organic superconductors, 11:11595 (J;GB)
TMX DEVICES
Infrared Thermography
Infrared thermography of first wall components on TMX-U, 11:12501 (R;US)

Magnetic-Pumping Heating
Electrical configuration for magnetic drift pumping on the tandem mirror experiment-upgrade (TMX-U), 11:12455 (R;US)
Plasma Diagnostics
Accelerator-based diagnostics in tandem-mirror fusion experiments, 11:12471 (J;NL)
TOKAMAK DEVICES
See also ALCATOR DEVICE
LT-4 TOKAMAK
PBX DEVICES
SPHEROMAK DEVICES
TEXTOR TOKAMAK
Alfven Waves
Low-n shear Alfven spectra in axisymmetric toroidal plasmas, 11:12452 (R;US)
Ballooning Instability
Accessibility of second regions of stability in tokamaks, 11:12454 (R;US)
Effects of an alpha particle slowing-down distribution on tokamak ballooning modes, 11:12443 (R;US)
Charged-Particle Transport Theory
SCORCH - a zero dimensional plasma evolution and transport code for use in small and large tokamak systems, 11:12425 (R;AU)
Design
Features of spherical torus plasmas, 11:12442 (R;US)
ECR Heating
Review of electron cyclotron heating experiments in toroidal devices, 11:12439 (R;US)
Stability of electron cyclotron waves in the presence of strong electron cyclotron heating, 11:12440 (R;US)
Electron Plasma Waves
Review of electron cyclotron heating experiments in toroidal devices, 11:12439 (R;US)
Fusion Yield
Acceleration of beam ions during major-radius compression in the tokamak fusion test reactor, 11:12464 (J;US)
Inhomogeneous Plasma
Effect of toroidicity during lower hybrid mode conversion, 11:12433 (R;US)
Kink Instability
Accessibility of second regions of stability in tokamaks, 11:12454 (R;US)
Magnetohydrodynamics
Low-n shear Alfven spectra in axisymmetric toroidal plasmas, 11:12452 (R;US)
Plasma Confinement
Long-time impurity confinement as a precursor to disruptions in ohmically heated tokamaks, 11:12468 (J;US)
q = 2 sawteeth and major disruptions in tokamaks, 11:12462 (J;US)
Review of electron cyclotron heating experiments in toroidal devices, 11:12439 (R;US)
Plasma Heating
Acceleration of beam ions during major-radius compression in the tokamak fusion test reactor, 11:12464 (J;US)
Hot-electron ring formation in tokamak plasmas, 11:12458 (J;US)
Long-time impurity confinement as a precursor to disruptions in ohmically heated tokamaks, 11:12468 (J;US)
Plasma Instability
Feedback control of resistive instabilities, 11:12449 (R;US)
Potentials
Comparison of the radial potential profile measured in a tokamak to predictions of stochastic magnetic field theory, 11:12469 (J;US)
Turbulence
Comments on "theory of dissipative density-gradient-driven turbulence in the tokamak edge" [Phys. Fluids 28, 1419 (1985)], 11:12450 (R;US)
TOKAMAK FUSION TEST REACTOR
See TFTR TOKAMAK
TOKAMAK TYPE REACTORS
See also DOUBLET REACTORS
TFTR TOKAMAK
Configuration
Configuration and structural design of Compact Ignition Tokamak, 11:12482 (R;US)
Design
Configuration and structural design of Compact Ignition Tokamak, 11:12482 (R;US)
Thermonuclear Ignition
Physics parameter space of tokamak ignition devices, 11:12429 (R;US)
Thermonuclear Reactor Walls
ORNL facilities for testing first-wall components, 11:12479 (R;US)
TOLUENE
Labelling
Mechanism of tritium-atom promoted isotope exchange in the benzene ring. 2. Substituent effects and a crossover in labelling mechanism, 11:11693 (J;US)
Thermal Conductivity
Thermal conductivities of Wilsonville solvent and Wilsonville solvent/Illinois No. 6 coal slurry, 11:10791 (R;US)
TOMOGRAPHY
See also COMPUTERIZED TOMOGRAPHY
Image Processing
Optimal regularization methods and their applications for tomography: new performing image reconstruction algorithms, 11:11975 (R;FR;In French)
TOOLS
Not for EDUCATIONAL TOOLS.
Fabrication
Method for producing hard-surfaced tools and machine components, 11:11541 (P;US)
TOP PARTICLES
Leptonic Decay
JADE: search for new particles and tests of Standard Model, 11:12146 (RA;US)
Particle Production
JADE: search for new particles and tests of Standard Model, 11:12146 (RA;US)
TOTAL-ABSORPTION SPECTROMETERS
See SHOWER COUNTERS
TOXIC MATERIALS
Environmental Exposure Pathway
Development of statistical distributions or ranges of standard factors used in exposure assessments. Final report, 11:12026 (R;US)
Environmental Impacts
Toxic effects on individuals, populations, and aquatic ecosystems and indicators of exposure to chemicals, 11:11916 (R;US)
TPC
See PROJECTION SPARK CHAMBERS
TRACE ELEMENTS
See ELEMENTS
TRACK DETECTORS (DIELECTRIC)
See DIELECTRIC TRACK DETECTORS
TRANQUILIZERS
Labelling
Chemoradiotherapy of cancer: boronated antibodies and boron-containing derivatives of promazine and porphyrins for neutron capture therapy. Progress report, November 1984-October 1985, 11:11973 (R;US)
TRANQUILLIZERS
See TRANQUILIZERS
TRANSFER (ELECTRON)
See ELECTRON TRANSFER
TRANSFER (HEAT)
See HEAT TRANSFER
TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION
TRANSFER REACTIONS
For nuclear reactions only; see also CHARGE EXCHANGE and ELECTRON TRANSFER.
Dirac Equation
Studies of nuclear structure via polarization transfer experiments, 11:12282 (R;US)
TRANSFORMATIONS (PHASE)
See PHASE TRANSFORMATIONS
TRANSFORMER OILS
See INSULATING OILS

TRANSFORMERS
Hot Spots
Optical temperature sensors for transformers. Final report, 11:11771 (R;US)
Insulating Oils
Characteristics of insulating oil for electrical applications. Volume 2. Effect of copper and aluminum on two types of paraffinic insulating oils. Final report, 11:11773 (R;US)
Characteristics of insulating oil for electrical applications. Volume 1. Evaluation of insulating oils for use in transformers, capacitors, and cables. Final report, 11:11772 (R;US)
Temperature Monitoring
Optical temperature sensors for transformers. Final report, 11:11771 (R;US)
TRANSIENTS
Electronic Circuits
Baseline compensation circuit for measurement of transient signals, 11:11776 (J;US)
Heat Transfer
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
Hydraulics
Reports on research programs in the area of reactor safety sponsored by the Ministry of Research and Technology (BMFT), April 1-June 30, 1976, 11:11359 (TG;US)
Measuring Methods
Baseline compensation circuit for measurement of transient signals, 11:11776 (J;US)
TRANSITION ELEMENT COMPOUNDS
See also CHROMIUM COMPOUNDS
COBALT COMPOUNDS
NIOBIUM COMPOUNDS
RUTHENIUM COMPOUNDS
TUNGSTEN COMPOUNDS
Chemistry
Application of quantum chemistry to atmospheric chemistry. Final report, 1 October 1983-30 September 1984, 11:11639 (R;US)
TRANSITION FLOW
Flow Models
Prediction of flow rates through an orifice at pressures corresponding to the transition between molecular and isentropic flow, 11:11763 (R;US)
TRANSITIONS (PHASE)
See PHASE TRANSFORMATIONS
TRANSMISSION (DATA)
See DATA TRANSMISSION
TRANSMISSION (HEAT)
See HEAT TRANSFER
TRANSMISSION LINES
See POWER TRANSMISSION LINES
TRANSPORT
Limited to the movement of goods and persons.
See also PNEUMATIC TRANSPORT
WASTE TRANSPORTATION
Insurance
Insurance-indemnity coverage for nuclear transportation: an overview, 11:11083 (R;US)
TRANSPORT (ENVIRONMENTAL)
See ENVIRONMENTAL TRANSPORT
TRANSPORT (GAMMA)
See PHOTON TRANSPORT
TRANSPORT (NEUTRON)
See NEUTRON TRANSPORT
TRANSPORT (PHOTON)
See PHOTON TRANSPORT
TRANSPORT THEORY
See also NEUTRON TRANSPORT THEORY
Computer Codes
Integrated Tiger Series of electron/photon Monte Carlo transport codes: a user's guide for use on IBM mainframes, 11:12386 (R;US)
TRANSPORTATION SYSTEMS
Automotive Fuels
Role of electric vehicles in the nation's energy future, 11:11493 (R;US)
Federal Assistance Programs
Financial and Compliance Report on Federally Assisted Programs for the year ended June 30, 1984, 11:11376 (R;US)
Fuel Substitution
Advanced propulsion systems and alternative fuels for non-highway transportation. Volume I. An assessment of unique and priority research and development opportunities. Final report, 11:11458 (R;US)
Advanced propulsion systems and alternative fuels for non-highway transportation. An assessment of unique and priority research and development opportunities. Volume III. A compendium of research and development. Final report., 11:11460 (R;US)
Advanced propulsion systems and alternative fuels for non-highway transportation. An assessment of unique and priority research and development opportunities. Volume II. Appendices. Final report, 11:11459 (R;US)
Propulsion Systems
Advanced propulsion systems and alternative fuels for non-highway transportation. Volume I. An assessment of unique and priority research and development opportunities. Final report, 11:11458 (R;US)
Advanced propulsion systems and alternative fuels for non-highway transportation. An assessment of unique and priority research and development opportunities. Volume III. A compendium of research and development. Final report., 11:11460 (R;US)
Advanced propulsion systems and alternative fuels for non-highway transportation. An assessment of unique and priority research and development opportunities. Volume II. Appendices. Final report, 11:11459 (R;US)
TRANSURANIUM WASTES
See ALPHA-BEARING WASTES
TREES
Short Rotation Cultivation
Economic analysis method for short-rotation forestry, 11:11158 (RA;PR)
TRIGA TYPE REACTORS
See also PSTR REACTOR
TRIGA-2-VIENNA REACTOR
Blackouts
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
Loss of Coolant
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
Primary Coolant Circuits
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
RHR Systems
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
Secondary Coolant Circuits
Modeling a TRIGA Power System with ATHENA, 11:11302 (R;US)
TRIGA-2-VIENNA REACTOR
Radiation Monitoring
Monitoring of airborne radioactivity at Austrian and Hungarian nuclear training reactors, 11:11278 (RA;AT)
Radioactive Effluents
Monitoring of airborne radioactivity at Austrian and Hungarian nuclear training reactors, 11:11278 (RA;AT)
TRIGA-PENNSYLVANIA REACTOR
See PSTR REACTOR
TRIPLET PARTICLES
See QUARKS
TRISTAN SEPARATOR
Recent developments at TRISTAN: nuclear structure studies of neutron-rich nuclei, 11:11792 (R;US)
TRITIATED COMPOUNDS
See TRITIUM COMPOUNDS
TRITIUM
Calorimetry
Measurement control assessment of radiometric calorimeters using nonstandards based indicators, 11:11096 (J;US)

Extraction
Irradiation of lithium aluminate and tritium extraction, 11:12474 (R;FR)
Isotopic Exchange
Mechanism of tritium-atom promoted isotope exchange in the benzene ring. 2. Substituent effects and a crossover in labelling mechanism, 11:11693 (J;US)
Mass Transfer
Gas exchange between the forest and the atmosphere, 11:11866 (R;US)
Nuclear Materials Management
Measurement control assessment of radiometric calorimeters using nonstandards based indicators, 11:11096 (J;US)
Radiation Monitoring
Elemental tritium deposition and conversion in the terrestrial environment, 11:11899 (R;CA)

TRITIUM COMPOUNDS
Tracer Techniques
Regulation of glycoprotein synthesis in yeast by mating pheromones, 11:11926 (RA;US)

TRITIUM SYSTEMS TEST ASSEMBLY
Research Programs
Current operations and experiments at the Tritium Systems Test Assembly, 11:12495 (R;US)

TRITIUM TARGET
Deuteron Reactions
Measurement and application of DDsub(γ), DTsub(γ) and D^{3}Hesub(γ) reactions at low energy, 11:12291 (J;NL)

TRITON REACTIONS
One-Nucleon Transfer Reactions
Low-energy nuclear reactions with hydrogen isotopes, 11:12290 (J;NL)

TRIUMF CYCLOTRON
Research Programs
Recent achievements in meson sciences at TRIUMF, 11:12164 (R;CA)

TRI-UNIVERSITY MESON FACILITY
See TRIUMF CYCLOTRON

TROPICAL REGIONS
Solar Water Heaters
Solar water heater for tropical countries, 11:11184 (RA;PR)

TRU WASTES
See ALPHA-BEARING WASTES

TRX-1
See REVERSE-FIELD PINCH

TSL PROCESS
Catalysts
Two-stage liquefaction catalyst evaluation. Final report, 11:10789 (R;US)
Organic Solvents
Coal liquefaction process solvent characterization and evaluation. Topical progress report, July 1, 1985-September 30, 1985, 11:10783 (R;US)
Yields
Coal liquefaction process solvent characterization and evaluation. Topical progress report, July 1, 1985-September 30, 1985, 11:10783 (R;US)
Two-stage liquefaction catalyst evaluation. Final report, 11:10789 (R;US)

TSTA
See TRITIUM SYSTEMS TEST ASSEMBLY

TUBES (CONDUITS)
See PIPES

TUFF
Compression Strength
Uniaxial and triaxial compression test series on Topopah Spring Tuff from USW G-4, Yucca Mountain, Nevada, 11:12033 (R;US)
Hydraulic Conductivity
Geohydrology of rocks penetrated by test well USW H-4, Yucca Mountain, Nye County, Nevada, 11:11040 (R;US)
Young Modulus
Uniaxial and triaxial compression test series on Topopah Spring Tuff from USW G-4, Yucca Mountain, Nevada, 11:12033 (R;US)

TUMORS
See NEOPLASMS

TUNGSTEN
Electrochemistry
Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)
Electron Emission
Negative-lithium emission from a tungsten surface in a plasma, 11:12119 (J;US)
Stability
Oxidation of $SOCl_2$ electrolyte on Mo, Ta, W, and Pt electrodes, 11:11700 (R;US)
Surface Properties
Hydrogen-induced reconstruction of stepped W(001) surfaces studied with LEED and EELS, 11:11506 (R;US)

TUNGSTEN COMPOUNDS
See also TUNGSTEN OXIDES
Chemical Preparation
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)
Molecular Structure
New metal-sulfur complexes from SO_2 reduction by (eta^5-C_5R_5)W(CO)$_3$H (R = H, Me): structures of [CpW(CO)$_3$]$_2$(μ-S) and [Cp/sup */W(CO)$_2$ (μ-S. SO)$_2$]$_2$, a complex with strong SO_2-sulfide bonding, 11:11657 (J;US)

TUNGSTEN OXIDES
Catalytic Effects
Improved catalysts for coal liquefaction. Quarterly report No. 5, September 1, 1985-November 30, 1985, 11:10785 (R;US)

TURBINE BLADES
Aerodynamics
Current methods for the dynamic analysis of horizontal axis wind turbines, 11:11209 (J;US)

TURBOFAN ENGINES
Compressors
Analysis of the effects of transient heat transfer on axial-flow-compressor-blade boundary layers. Master's thesis, 11:11762 (R;US)

TURBOGENERATORS
Reliability
Design problems of reliable turbogenerators 2, 11:11271 (RA;CS;In Russian)

TURBULENCE
Dynamics
Dynamics and fluctuation spectra of electrostatic resistive interchange turbulence, 11:12437 (R;US)
Spectra
Dynamics and fluctuation spectra of electrostatic resistive interchange turbulence, 11:12437 (R;US)

TURKEY
Research Programs
Progress report 1984, 11:12268 (R;TR;In Turkish)
Progress report of Cekmece Nuclear Research and Training Center 1983, 11:12269 (R;TR;In Turkish)

TWO-BODY PROBLEM
Integral Equations
Memory function approach to retardation effects in the relativistic two-body problem, 11:12242 (R;FR)
Relativistic Range
Memory function approach to retardation effects in the relativistic two-body problem, 11:12242 (R;FR)

U

UDPG
Uptake
Utilization of glucose and UDPG by supprotoplasts of cotton fiber cells, 11:11940 (RA;US)

UFTR REACTOR
Reactor Maintenance
University of Florida training reactor. Annual progress report, September 1, 1984-August 31, 1985, 11:11282 (R;US)

Reactor Operation
University of Florida training reactor. Annual progress report, September 1, 1984-August 31, 1985, 11:11282 (R;US)
ULTRACENTRIFUGE ENRICHMENT PLANTS
See CENTRIFUGE ENRICHMENT PLANTS
ULTRAHIGH-SPEED PHOTOGRAPHY
Illuminance
Laser-illuminated nano-second microscope, 11:11754 (J;US)
ULTRASONIC TESTING
Investigations of ultrasonic wave interactions at boundaries separating anisotropic materials. Progress report, 11:11768 (R;US)
Reliability
Reliability of inservice ultrasonic flaw detection, 11:11341 (R;US)
ULTRASONIC WAVES
Interfaces
Investigations of ultrasonic wave interactions at boundaries separating anisotropic materials. Progress report, 11:11768 (R;US)
ULTRASONICS
See ULTRASONIC WAVES
UNCERTAINTY
See DATA COVARIANCES
UNDERGROUND DISPOSAL
Risk Assessment
Analysis of alternatives for greater-confinement disposal of low-level radioactive waste, 11:11002 (R;US)
UNDERGROUND GASIFICATION
See IN-SITU GASIFICATION
UNDERGROUND MINING
See also LONGWALL MINING
Ground Water
Design of bulkheads for controlling water in underground mines. Information Circular/1985, 11:10824 (R;US)
Personnel
Biomechanical and work physiology study in underground mining, excluding low coal. Open file report, 25 January 1980-22 July 1984, 11:12027 (R;US)
Supports
Empirical methods of support design for the Sydney coalfield, 11:10820 (R;CA)
Recognizing signs of excessive loading in underground coal mines. Information Circular/1985, 11:10925 (R;US)
UNDERGROUND NUCLEAR POWER PLANTS
See UNDERGROUND NUCLEAR STATIONS
UNDERGROUND NUCLEAR STATIONS
Containment Systems
Concept of underground nuclear power plant siting for retaining post accident atmospheres, 11:11354 (R;US)
Reactor Accidents
Concept of underground nuclear power plant siting for retaining post accident atmospheres, 11:11354 (R;US)
UNIFIED GAUGE MODELS
See also GRAND UNIFIED THEORY
WEINBERG LEPTON MODEL
Gravitation
Analogue of the Witten effect in the Poincare gauge theory of gravity, 11:12231 (R;IT)
Lattice Field Theory
Quarkonia spectra from lattice gauge theories, 11:12266 (J;NL)
Poincare Groups
Analogue of the Witten effect in the Poincare gauge theory of gravity, 11:12231 (R;IT)
UNITED KINGDOM
Coal Mining
First observations of ecological surveillance plots on afforested open-cast spoil in South Wales. Occasional paper, 11:10810 (R;GB)
UNITED STATES OF AMERICA
See USA
UNIVERSE
Magnetic Fields
Closed homogeneous cosmological model with short range magnetic field, 11:12038 (R;BR;In Portuguese)
Phase Transformations
Formation of structures in the very early universe, 11:12040 (R;BR)
Symmetry
Closed homogeneous cosmological model with short range magnetic field, 11:12038 (R;BR;In Portuguese)
Universe symmetries, 11:12039 (R;FR;In French)
UNIVERSITY OF FLORIDA REACTOR
See UFTR REACTOR
UNSTEADY FLOW
Flow Models
Calculation of sliding interfaces of two-dimensional unsteady flow, 11:11767 (TG;US)
URANIUM
Diffusion
Experimentation and modelling of U, Th, and lanthanides transport in fissured rocks. Influence of complexation, 11:11057 (R;FR)
Dosimetry
Introduction to the USUR data, 11:12001 (R;US)
Extraction Chromatography
Ten years of experience in extraction chromatographic processes for the recovery, separation and purification of actinide elements, 11:11613 (RA;XA)
Ion Exchange Chromatography
Ion exchange characteristics of hydrous oxides and their use in the separation of uranium and thorium, 11:11612 (RA;XA)
Market
A new era in U.S. uranium enrichment, 11:10981 (J;US)
Mass Spectroscopy
Evaluation of uranium and plutonium internal standards, 11:11619 (R;US)
ISPO Task A-126: application of mixed internal standards to the mass spectrometric analysis of plutonium and uranium in spent fuel dissolver solutions: ORNL results, 11:11721 (R;US)
Nuclear Materials Management
The results of the NLO error propagation exercise, 11:11099 (J;US)
Occupational Exposure
Introduction to the USUR data, 11:12001 (R;US)
Radiochemical Analysis
Techniques of sample attack used in soil and mineral analysis. Phase I, 11:11614 (R;CA)
Radionuclide Migration
Source term modelling in the Swedish KBS - 3 study, 11:11063 (RA;US)
Reduction
Large-scale electrolytic reduction of U(VI) to U(IV), 11:10978 (R;CA)
Tissue Distribution
Introduction to the USUR data, 11:12001 (R;US)
URANIUM 233
Delayed Neutron Analysis
Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel, 11:11108 (J;US)
Isotope Ratio
Evaluation of uranium and plutonium internal standards, 11:11619 (R;US)
URANIUM 234 TARGET
Electrofission
Observation of M1 strength in the photofission of actinide nuclei, 11:12353 (R;BR)
URANIUM 235
Delayed Neutron Analysis
Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel, 11:11108 (J;US)
Isotope Ratio
Evaluation of uranium and plutonium internal standards, 11:11619 (R;US)
ISPO Task A-126: application of mixed internal standards to the mass spectrometric analysis of plutonium and uranium in spent fuel dissolver solutions: ORNL results, 11:11721 (R;US)
Nuclear Materials Management
Automatic material identifier, 11:11101 (J;US)

URANIUM 235 TARGET
Photofission
Non-electric-dipole photofission of ^{235}U, 11:12352 (R;BR)
URANIUM 236
Isotope Ratio
Evaluation of uranium and plutonium internal standards, 11:11619 (R;US)
URANIUM 236 TARGET
Electrofission
Observation of M1 strength in the photofission of actinide nuclei, 11:12353 (R;BR)
URANIUM 238
Delayed Neutron Analysis
Delayed neutron method for measurement of fissile/fertile content of samples ranging from environmental to irradiated fuel, 11:11108 (J;US)
Isotope Ratio
Evaluation of uranium and plutonium internal standards, 11:11619 (R;US)
ISPO Task A-126: application of mixed internal standards to the mass spectrometric analysis of plutonium and uranium in spent fuel dissolver solutions: ORNL results, 11:11721 (R;US)
Photofission
High resolution studies of photofission of ^{232}Th and ^{238}U, 11:12349 (R;US)
URANIUM 238 TARGET
Argon 40 Reactions
Linear momentum transfer in the $^{40}Ar + ^{238}U$ system for projectile energies from 20 to 44 MeV/u, 11:12348 (R;FR)
Sequential fission angular distributions from mass-asymmetric heavy-ion reactions, 11:12346 (J;NL)
Electrofission
Observation of M1 strength in the photofission of actinide nuclei, 11:12353 (R;BR)
Intermediate Structure
High resolution photofission measurements in ^{238}U and ^{232}Th. Final report (5.8 to 12 MeV), 11:12350 (R;US)
Photofission
High resolution photofission measurements in ^{238}U and ^{232}Th. Final report (5.8 to 12 MeV), 11:12350 (R;US)
URANIUM ALLOYS
Collective Excitations
Observation of a collective mode in superconducting UBe_{13}, 11:11536 (J;US)
Electron Spin Resonance
ESR in a heavy-fermion alloy (UBe_{13}) doped with local moments, 11:11535 (J;US)
URANIUM DEPOSITS
Prospecting
Current research, 11:10974 (R;CA)
Uranium in the Circum-Ungava belt, northern Quebec and Labrador. New information form the central Labrador Trough, 11:10975 (RA;CA)
URANIUM DIOXIDE
Dissolution
Chemistry of nuclear fuel (UO_2) dissolution under waste disposal vault conditions, 11:11722 (RA;US)
Potential effect of water influx on the dissolution rate of UO_2 in spent fuel at the Yucca Mountain, Nevada site, 11:11559 (R;US)
URANIUM HEXAFLUORIDE
Gamma Detection
Results from the study of UF_6 consumption on centrifuge process piping and its influence on gamma ray measurements, 11:10982 (J;US)
Hydrolysis
Sampling, characterization, and remote sensing of aerosols formed in the atmospheric hydrolysis of uranium hexafluoride, 11:11070 (J;US)
Source Terms
Calculational methods for analysis of postulated UF_6 releases. Volume 2, 11:11078 (R;US)
URANIUM IONS
Collisions
Charge changing cross sections of relativistic uranium, 11:12116 (J;NL)
URANIUM ISOTOPES
See also URANIUM 233
URANIUM 235
URANIUM 236
URANIUM 238
Isotope Separation
Uranium isotope separation by magnetic field gradient and visible light acting in a liquid medium, 11:10980 (TG;US)
URANIUM MINES
Health Hazards
Recommendations concerning an interim annual individual exposure limit for respirable quartz, 11:11077 (R;CA)
Ventilation
Computer modelling of an underground mine ventilation system (VENTRAD; VENTRPROG), 11:10977 (R;CA)
Ventilation Systems
Membrane barriers for radon gas flow restrictions, 11:10976 (R;CA)
URANIUM ORES
Economics
Economics of Australian uranium mining, 11:10993 (R;XA)
Mineralogy
Current research, 11:10974 (R;CA)
Petrography, petrochemistry and mineral associations of selected rocks and radioactive occurrences north of Mont-Laurier, Quebec. A progress report, 11:10973 (RA;CA)
Summary on uranium in Canada, 1984, 11:10972 (RA;CA)
Mining
Economics of Australian uranium mining, 11:10993 (R;XA)
Petrology
Petrography, petrochemistry and mineral associations of selected rocks and radioactive occurrences north of Mont-Laurier, Quebec. A progress report, 11:10973 (RA;CA)
URANIUM PHOSPHATES
Chemical Preparation
Synthesis and characterization of crystalline phosphate of thorium, uranium and neptunium, 11:11725 (J;CH)
Quantitative Chemical Analysis
Synthesis and characterization of crystalline phosphate of thorium, uranium and neptunium, 11:11725 (J;CH)
URANIUM SILICIDES
Thermal Conductivity
Thermal conductivities of U_3Si and U_3Si_2-Al dispersion fuels, 11:11280 (R;US)
URANYL COMPOUNDS
See also URANYL FLUORIDES
URANYL NITRATES
Chemical Reactions
Interaction of uranyl ions in carbonate media, 11:11727 (J;NL)
URANYL FLUORIDES
Aerosol Monitoring
Sampling, characterization, and remote sensing of aerosols formed in the atmospheric hydrolysis of uranium hexafluoride, 11:11070 (J;US)
URANYL NITRATES
Reduction
Assessment of photochemical applications to specific stages in Savannah River Plant actinide reprocessing streams, 11:10988 (R;US)
UREA
Structural Chemical Analysis
Solid state studies. 29. Crystalline urea: evidence for vibrational delocalization, 11:11676 (J;US)
URIDINE
Quantitative Chemical Analysis
Analysis of pseudouridine by fluorescence spectrometry, 11:11678 (J;US)
UROCANIC ACID
Biosynthesis
Endogenous acceptors for polyuronide biosynthesis in Mucor rouxii, 11:11969 (RA;US)
UROCYON
See FOXES
US BUREAU OF MINES
Budgets
Bureau of Mines authorization and oversight. Hearing before the Subcommittee on Transportation, Aviation and Materials

of the Committee on Science and Technology, US House of Representatives, Ninety-Ninth Congress, First Session, April 24, 1985 (1986 proposed), 11:11381 (B;US)

Hearings

Bureau of Mines authorization and oversight. Hearing before the Subcommittee on Transportation, Aviation and Materials of the Committee on Science and Technology, US House of Representatives, Ninety-Ninth Congress, First Session, April 24, 1985 (1986 proposed), 11:11381 (B;US)

Research Programs

Bureau of Mines authorization and oversight. Hearing before the Subcommittee on Transportation, Aviation and Materials of the Committee on Science and Technology, US House of Representatives, Ninety-Ninth Congress, First Session, April 24, 1985 (1986 proposed), 11:11381 (B;US)

US DEPARTMENT OF AGRICULTURE

See US DOA

US DOA

Budgets

Proposed fiscal year 1986 budget request. Hearings before the Committee on Energy and Natural Resources, United States Senate, Ninety-Ninth Congress, First Session, February 27, March 1 and 4, 1985, 11:11380 (B;US)

US DOE

See also BNL
BONNEVILLE POWER ADMINISTRATION
FEED MATERIALS PRODUCTION CENTER
HANFORD RESERVATION
HAPO
IDAHO NATIONAL ENGINEERING LABORATORY
NEVADA TEST SITE
OAK RIDGE RESERVATION
ORNL
PANTEX PLANT
PORTSMOUTH GASEOUS DIFFUSION PLANT
SAVANNAH RIVER PLANT
US FERC
US MSHA
WIPP

Administrative Procedures

DOE oversight of facility confirmatory measurement activity, 11:11098 (J;US)

Fiscal year 1986, Department of Energy authorization (magnetic fusion energy and departmental administration and supporting services activities). Volume V. Hearings before the Subcommittee on Energy Research and Production of the Committee on Science and Technology, House of Representatives, Ninety-Ninth Congress, First Session, March 8, 18, 1985, 11:12424 (B;US)

Budgets

DOE's fiscal year 1986 budget. Hearings before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Ninth Congress, First Session, 11:11396 (B;US)

Fiscal year 1986 Department of Energy authorization (fossil energy). Volume 1. Hearing before the Subcommittee on Energy Development and Applications of the Committee on Science and Technology, US House of Representatives, Ninety-Ninth Congress, First Session, March 6, 1985, 11:11386 (B;US)

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Proposed fiscal year 1986 budget request. Hearings before the Committee on Energy and Natural Resources, United States Senate, Ninety-Ninth Congress, First Session, February 27, March 1 and 4, 1985, 11:11380 (B;US)

Energy Management

Ten-Year Inhouse Energy Management Plan, 11:11444 (R;US)

Federal Assistance Programs

Department of Energy Annual Procurement and Federal Assistance report, FY 1985, 11:12512 (R;US)

Procurement

Department of Energy Annual Procurement and Federal Assistance report, FY 1985, 11:12512 (R;US)

Research Programs

Potential safety enhancements to nuclear plant control: Proof testing at EBR-II, 11:11277 (BA;US)

US DOI

See also US BUREAU OF MINES

Budgets

Proposed fiscal year 1986 budget request. Hearings before the Committee on Energy and Natural Resources, United States Senate, Ninety-Ninth Congress, First Session, February 27, March 1 and 4, 1985, 11:11380 (B;US)

US FDA

Research Programs

Annual report of the Division of Life Sciences (formerly Division of Risk Assessment). Fiscal year 1983. Report for 1 October 1982-30 September 1983, 11:11999 (R;US)

US FERC

Budgets

DOE's fiscal year 1986 budget. Hearings before the Subcommittee on Energy Conservation and Power of the Committee on Energy and Commerce, House of Representatives, Ninety-Ninth Congress, First Session, 11:11396 (B;US)

US MSHA

Regulations

Rollover protective structures (ROPS) inspection and maintenance guide. Information circular/1985, 11:10923 (R;US)

US NRC

United States Nuclear Regulatory Commission-prior to 1975 was part of US AEC.

Regulations

Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)

Indexes to Nuclear Regulatory Commission Issuances, July-September 1985. Volume 22, Index 1, 11:11263 (R;US)

Research Programs

Objective of the NRC high-level research program at BNL, 11:11054 (J;US)

Risk Assessment

Value impact assessment of standard review plan sections, 11:11347 (R;US)

USA

See also EAST COAST
GULF COAST

Arms Control

Evaluation of alternative nuclear employment policy/technology. Executive summary - strategy, technology, and the threat. Technical report, 1 February-31 December 1982, 11:11853 (R;US)

Coordinated Research Programs

Introducing indigenous coal-water-mix fuels to the Philippines: assessment of project feasibility, 11:10892 (RA;US)

Enriched Uranium

A new era in U.S. uranium enrichment, 11:10981 (J;US)

Petroleum Industry

Price controls, price dispersion, and the supply of refined petroleum products, 11:10936 (J;GB)

UTAH

Radioactive Waste Disposal

Managing the nation's nuclear waste. Site descriptions: Cypress Creek, Davis Canyon, Deaf Smith, Hanford Reference, Lavender Canyon, Richton Dome, Swisher, Vacherie Dome, and Yucca Mountain, 11:11007 (R;US)

UTILITIES

See ELECTRIC UTILITIES

V

V-1 REACTOR (BOHUNICE)

See BOHUNICE V-1 REACTOR

VACCINES
Radioinduction
Murine immunization by cesium-137 irradiation attenuated Schistosoma mansoni cercariae, 11:11992 (R;US)
VACUUM STATES
Decay
Decay rate of the false vacuum at high temperatures, 11:12236 (R;BR)
VALENCE ELECTRONS
See ELECTRONS
VALVES
Failures
Aging and service wear of check valves used in engineered safety-feature systems of nuclear power plants. Volume 1. Operating experience and failure identification, 11:11273 (R;US)
Monitoring
Valve monitor designs for security applications, 11:11089 (J;US)
Reliability
Reliability of power plant supply pumps and special valves, 11:11272 (RA;CS;In Czech)
VAN ALLEN BELTS
See RADIATION BELTS
VANADIUM MINERALS
See MINERALS
VANADIUM OXIDES
Crystal Structure
Lithium insertion in $V_3Nb_6O_{20}$. A Wadsley-Roth type phase. Technical report, June 1984-July 1985, 11:11361 (R;US)
VANS
Freezers
Vehicle refrigeration, 11:11496 (RA;DE;In German)
Refrigerators
Comparative studies on deep freeze distribution vehicles, 11:11497 (RA;DE;In German)
Vehicle refrigeration, 11:11496 (RA;DE;In German)
VECTOR MESONS
See also PHI-1019 RESONANCES
Decay Amplitudes
Vector meson and axial-vector diquark decay constants, 11:12180 (R;BR)
VEGETABLE OILS
Prior to March 1983 this concept was indexed to PLANTS and OILS.
Energy Policy
Vegetable oils as substitutes for diesel oil, 11:11127 (RA;PR)
Fuel Substitution
New diesel engine development for the use of vegetable oil as a fuel, 11:11500 (RA;DE;In German and English)
Practical experiences with rape-seed oil ester as fuel for tractors, 11:11501 (RA;DE;In German and English)
Vegetable oils as substitutes for diesel oil, 11:11127 (RA;PR)
VEGETABLES
Edible parts of plants only; see also FRUITS.
Contamination
Lead as an environmental pollutant, 11:11895 (RA;XE)
Solar Drying
Development of simple air collectors for drying agricultural produce in developing countries, 11:11197 (RA;DE;In German)
VEGETATION
See PLANTS
VEHICLES
See also AUTOMOBILES
ELECTRIC-POWERED VEHICLES
VANS
Flywheels
Matched metal die compression molded structural random fiber fiber sheet molding compound flywheel, 11:11495 (P;US)
Hybrid Systems
Matched metal die compression molded structural random fiber fiber sheet molding compound flywheel, 11:11495 (P;US)
VENTILATION
Computerized Simulation
Computer modelling of an underground mine ventilation system (VENTRAD; VENTRPROG), 11:10977 (R;CA)
VENTILATION DUCTS
See VENTILATION
VENTILATION SYSTEMS
Air Filters
Membrane barriers for radon gas flow restrictions, 11:10976 (R;CA)
VERTEBRATES
See also FISHES
Biological Radiation Effects
Effects of irradiation on frozen corticocancellous bone allograft incorporation and immunogenicity. Final report, 11:11988 (R;US)
Radioimmunology
Effects of irradiation on frozen corticocancellous bone allograft incorporation and immunogenicity. Final report, 11:11988 (R;US)
VESSELS
See CONTAINERS
VESSELS (PRESSURE)
See PRESSURE VESSELS
VIBRATIONS (MECHANICAL)
See MECHANICAL VIBRATIONS
VINYL RADICALS
Chemical Preparation
Gas-phase radical formation during the reactions of methane, ethane, ethylene, and propylene over selected oxide catalysts, 11:11675 (J;US)
VIRUSES
Radiometric Analysis
Radiometric methods for rapid diagnosis of viral infection. Annual report, 1 February 1976-31 January 1977, 11:11984 (R;US)
VISCOSIMETERS
Design
Method and apparatus for measuring shear modulus and viscosity of a monomolecular film, 11:11766 (P;US)
VISCOSITY
Measuring Instruments
Viscosity of low-rank coal slags, 11:10904 (RA;US)
Measuring Methods
Method and apparatus for measuring shear modulus and viscosity of a monomolecular film, 11:11766 (P;US)
VISITOR CENTERS
See PUBLIC BUILDINGS
VITRINITE
See MACERALS
VOLTAIC CELLS
See ELECTRIC BATTERIES
VULNERABILITY
Classification of vulnerability information, 11:11094 (J;US)
VULPES
See FOXES

W

WALLS
Thermal Conductivity
Calibrated hot box test results data manual. Volume II. Final report, 11:11448 (R;US)
WASHINGTON
Coal Gasification
Next phase of WIDCO's Tono project, 11:10777 (RA;US)
Preliminary results of postburn coring and drilling at WIDCo-CRIP UCG experimental test site, Centralia, Washington, 11:10749 (RA;US)
Results of the Centralia underground coal gasification field test, 11:10744 (RA;US)
WIDCO Partial Seam CRIP test: impact of gas characteristics on processing requirements, 11:10750 (RA;US)

Radioactive Waste Disposal
Managing the nation's nuclear waste. Site descriptions: Cypress Creek, Davis Canyon, Deaf Smith, Hanford Reference, Lavender Canyon, Richton Dome, Swisher, Vacherie Dome, and Yucca Mountain, 11:11007 (R;US)

WASTE BURIAL
See UNDERGROUND DISPOSAL

WASTE DISPOSAL
See also RADIOACTIVE WASTE DISPOSAL
SANITARY LANDFILLS
UNDERGROUND DISPOSAL
Interest Groups
Emergence of interest groups on hazardous waste siting: how do they form and survive, 11:11389 (R;US)
Remedial Action
Status of EPA's remedial cleanup efforts, 11:11378 (R;US)

WASTE FORMS
Field Tests
Low level waste data base development - EPICOR-II resin/liner investigation. Program review, 11:11013 (R;US)
Performance
BNL high-level waste technical assistance programs for support of the NRC, 11:11053 (J;US)
Thermal Conductivity
Thermal properties of fly ash substituted slag cement waste forms for disposal of Savannah River Plant salt waste, 11:11010 (R;US)

WASTE HEAT UTILIZATION
Energy recovery from existing municipal incinerators. Final report, 11:11479 (R;US)
Heat Pipes
Ceramic heat pipe waste heat recovery. Phase I report, August 1, 1984-April 30, 1985, 11:11477 (R;US)

WASTE ISOLATION PILOT PLANT
See WIPP

WASTE SOLUTIONS
See LIQUID WASTES

WASTE TRANSPORTATION
Hazards
Hydrogen control in the handling, shipping and storage of wet radioactive waste, 11:11079 (R;US)

WASTE WATER
Anaerobic Digestion
Anaerobic SBR treatment of coal conversion wastewaters. First quarterly report, 11:10804 (R;US)
Detoxification
Anaerobic treatment of gasifier effluents. Final report, 11:10803 (R;US)
Quantitative Chemical Analysis
Characterization of mercury, arsenic, and selenium in the product streams of the Pacific Northwest Laboratory 6-kg retort, 11:10969 (R;US)
Recycling
Liquefaction, 11:10739 (RA;US)
Toxicity
Application of acute bioassays in evaluating the treatment of coal liquefaction wastewaters, 11:10929 (J;US)
Water Treatment
Control of acid mine drainage. Proceedings of a technology-transfer seminar. Information circular/1985, 11:10811 (R;US)
Gasification, 11:10736 (RA;US)
Research on wastewater treatment and reuse for coal gasification and liquefaction, 11:10738 (RA;US)

WASTEFORMS
See WASTE FORMS

WASTE-FUELED POWER PLANTS
See REFUSE-FUELED POWER PLANTS

WATER
See also DRINKING WATER
FRESH WATER
GROUND WATER
HEAVY WATER
WASTE WATER
Charged-Particle Reactions
Physical and chemical events that follow the passage of a charged particle in liquid water, 11:12389 (R;US)
Charged-Particle Transport
Physical and chemical events that follow the passage of a charged particle in liquid water, 11:12389 (R;US)
Chemical Analysis
Analysis of extractable priority pollutants in water by gas chromatography/mass spectroscopy, 11:11915 (R;US)
Interfaces
Effects of molecular organization on photophysical behavior: lifetime and steady-state fluorescence of chlorophyll a singlets in monolayers of dioleoylphosphatidylcholine at the nitrogen-water interface, 11:11687 (J;US)
Phase Diagrams
Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)
Piezometry
Selection of adsorbates for chemical sensor arrays by pattern recognition, 11:11629 (J;US)
Radiolysis
Formation of hydrogen in the radiolysis of water in closed volumes, 11:11711 (RA;XA)
Raman Effect
Spontaneous Raman scattering from shocked water, 11:12136 (J;US)
Thermodynamic Activity
Design and synthesis procedure for homogeneous and heterogeneous azeotropic distillations, 11:11610 (R;US)
Wave Propagation
Spontaneous Raman scattering from shocked water, 11:12136 (J;US)
X-Ray Spectra
Ion-excited K X-ray spectra of oxygen, 11:12076 (RA;US)

WATER CONTENT
See MOISTURE

WATER COOLANT
See WATER

WATER COOLED REACTORS
See also BWR TYPE REACTORS
HFIR REACTOR
ORR REACTOR
OSIRIS REACTOR
PWR TYPE REACTORS
TRIGA TYPE REACTORS
Loss of Coolant
TRAC-PF1/MOD1 independent assessment: LOBI large break transient A1-04R, 11:11330 (R;US)
Meltdown
Aerosol generation by liquid breakup resulting from sparging of molten pools of corium by gases released during core/concrete interactions, 11:11355 (J;US)

WATER DISTRIBUTION
See WATER SUPPLY

WATER MODERATED REACTORS
See also BWR TYPE REACTORS
HFIR REACTOR
ORR REACTOR
OSIRIS REACTOR
PWR TYPE REACTORS
TRIGA TYPE REACTORS
Meltdown
Aerosol generation by liquid breakup resulting from sparging of molten pools of corium by gases released during core/concrete interactions, 11:11355 (J;US)

WATER MODERATOR
See WATER

WATER POLLUTION
Analysis of extractable priority pollutants in water by gas chromatography/mass spectroscopy, 11:11915 (R;US)
Oil in the sea: inputs, fates, and effects. Final report, 11:10941 (R;US)

WATER SOLUTIONS
See AQUEOUS SOLUTIONS

WATER SOURCE HEAT PUMPS
Heat Exchangers
Heat exchanger requirements for potable water protection. Final report, 11:11446 (R;US)

WATER SUPPLY
Used in the sense of a public utility or of an engineered system (e.g., irrigation system) as contrasted to a natural system, for which use WATER RESOURCES.
Decontamination
Radiological water decontamination study, 11:11918 (R;US)

WATER TREATMENT
Evaluation
Application of acute bioassays in evaluating the treatment of coal liquefaction wastewaters, 11:10929 (J;US)
Research Programs
Research on wastewater treatment and reuse for coal gasification and liquefaction, 11:10738 (RA;US)
WATER TREATMENT PLANTS
Design
Development of design criteria for waste stabilization ponds in the Western Pacific Islands, 11:11481 (RA;PR)
WATER VAPOR
Mass Transfer
Gas exchange between the forest and the atmosphere, 11:11866 (R;US)
Muonium
Muonium formation in vapors, 11:12091 (R;CA)
WATERBORNE PARTICLES
See PARTICULATES
WAVE POWER
Research Programs
Hawaii Natural Energy Institute annual report, July 1982-June 1983, 11:11405 (R;US)
Hawaii Natural Energy Institute annual report, July 1981-June 1982, 11:11383 (R;US)
WAVEGUIDES
Mode Selection
Pure mode swept frequency TE_{on} measurements in 6.35 cm circular waveguide, 11:12484 (R;US)
WAVES (SHOCK)
See SHOCK WAVES
WAXES
Molecular Structure
Fungal penetration of defensive barriers of plants, 11:11933 (RA;US)
WEAK BOSON
See INTERMEDIATE VECTOR BOSONS
WEAK HADRONIC DECAY
CP Invariance
[Review of experiments measuring CP nonconservation], 11:12154 (R;US)
Matrix Elements
Lattice calculation of weak matrix elements, 11:12212 (J;US)
WEAK INTERACTIONS
See also FERMI INTERACTIONS
Quenching
Stellar weak interaction rates: the issue of quenching, 11:12360 (R;US)
WEAPONS
See also NUCLEAR WEAPONS
Government Policies
Evaluation of alternative nuclear employment policy/technology. Executive summary - strategy, technology, and the threat. Technical report, 1 February-31 December 1982, 11:11853 (R;US)
WECS
See WIND TURBINES
WEINBERG LEPTON MODEL
Baryon Number
Anomalous electroweak baryon number non-conservation in the early universe, 11:12183 (R;IT)
Electron-Positron Interactions
Capabilities of e^+e collisions for producing very heavy Higgs bosons, 11:12216 (J;NL)
Phase Transformations
Anomalous electroweak baryon number non-conservation in the early universe, 11:12183 (R;IT)
WEINBERG MODEL
See WEINBERG LEPTON MODEL
WELDED JOINTS
Cracks
Precipitate formation in austenitic stainless steel welds, 11:11545 (J;US)
Hardness
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1985, 11:10790 (R;US)
Thickness
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1985, 11:10790 (R;US)
WELDS
See WELDED JOINTS
WEST GERMANY
See FEDERAL REPUBLIC OF GERMANY
WETLANDS
Ecology
Ecological research at the Savannah River Ecology Laboratory. Annual report for the period ending July 31, 1985, 11:11921 (R;US)
WHISTLERS
Effects of whistler-mode and other waves in the magnetosphere. Final report 1981-1984, 11:12053 (R;US)
WIGGLER MAGNETS
Ondulators and Wigglers - Theoretical aspects, 11:11794 (R;BR;In Portuguese)
WIGNER THEORY
Kernels
From GCM energy kernels to Weyl-Wigner Hamiltonians: a particular mapping, 11:12403 (R;BR)
WILSON LOOP
Cusped Geometries
Influence of cusps and intersections on the calculation of the Wilson loop in ν-dimensional space, 11:12257 (R;BR)
Potentials
Some remarks about the classical Wilson loop for a class of gauge field copies, 11:12256 (R;BR)
Temperature Dependence
High temperature interparticle potential for an alternative gauge model, 11:12219 (R;BR)
WIND ENERGY CONVERSION SYSTEMS
See WIND TURBINES
WIND GENERATORS
See WIND TURBINES
WIND POWER
Energy Recovery
Energy recovered by using balloons and cylinders, 11:11207 (RA;PR)
Research Programs
Hawaii Natural Energy Institute annual report, July 1982-June 1983, 11:11405 (R;US)
Hawaii Natural Energy Institute annual report, July 1981-June 1982, 11:11383 (R;US)
Hawaii Natural Energy Institute annual report, 1984, 11:11384 (R;US)
Resource Assessment
Community supported wind resource monitoring network, 11:11208 (RA;PR)
Correlations between short term and long term wind observation data in Ceer Toa Baja energy experimental farm, 11:11205 (RA;PR)
Potential of wind energy in Rajasthan state (India): a case study, 11:11204 (RA;PR)
WIND TURBINES
Dynamics
Current methods for the dynamic analysis of horizontal axis wind turbines (FLAP: Force and Loads analysis programs), 11:11209 (J;US)
Economics
Correlations between short term and long term wind observation data in Ceer Toa Baja energy experimental farm, 11:11205 (RA;PR)
Performance
Dimetrodon performance summary: energy systems and the evolution of an ecological community design process, 11:11445 (R;US)
WINDOWS
Energy Conservation
Window performance and building energy use: some technical options for increasing energy efficiency, 11:11454 (J;US)
Energy Efficiency
Energy sources: conservation and renewables, 11:11450 (B;US)

WIND-POWERED PUMPS
Wind-mechanical pumps only; for wind-electric pumps use WIND TURBINES and PUMPS.
Cost
Potential of wind energy in Rajasthan state (India): a case study, 11:11204 (RA;PR)
WINE
See BEVERAGES
WIPP
Baseline Ecology
Ecosystem studies at the Los Medanos site, Eddy County, New Mexico. Volume II, 11:11043 (R;US)
Ecosystem studies at the Los Medanos site, Eddy County, New Mexico. Volume I, 11:11042 (R;US)
Design
Stress control technique: its history and suitability for WIPP, 11:11041 (R;US)
The radioactive waste disposal problem has a solution - the Waste Isolation Pilot Plant project, 11:11051 (J;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 1, 11:11072 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 2, 11:11073 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 3, 11:11074 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 4, 11:11075 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 5, 11:11076 (R;US)
Environmental Impacts
Radiological consequences of brine release by human intrusion into WIPP, 11:11923 (R;US)
Safety
Waste Isolation Pilot Plant Safety Analysis Report. Volume 1, 11:11072 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 2, 11:11073 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 3, 11:11074 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 4, 11:11075 (R;US)
Waste Isolation Pilot Plant Safety Analysis Report. Volume 5, 11:11076 (R;US)
WNP-1 REACTOR
Compliance
Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, WNP, Unit Nos. 1 and 3 (Docket Nos. 50-460 and 50-508), 11:11262 (R;US)
WNP-3 REACTOR
Compliance
Conformance to Generic Letter 83-28, Items 3.1.3 and 3.2.3, WNP, Unit Nos. 1 and 3 (Docket Nos. 50-460 and 50-508), 11:11262 (R;US)
WOLFRAM
See TUNGSTEN
WOOD
Air Pollution
Modeling and testing of formaldehyde emission characteristics of pressed-wood products. Reports XII, XIII, and XIV to the US Consumer Product Safety Commission, 1985, 11:11868 (R;US)
Combustion
Displacement of industrial oil consumption in developing countries by wood fuel technologies, 11:11148 (RA;PR)
Gasification
Displacement of industrial oil consumption in developing countries by wood fuel technologies, 11:11148 (RA;PR)
Pyrolysis
Displacement of industrial oil consumption in developing countries by wood fuel technologies, 11:11148 (RA;PR)
WOOD ALCOHOL
See METHANOL
WOOD BURNING FURNACES
Economics
Displacement of industrial oil consumption in developing countries by wood fuel technologies, 11:11148 (RA;PR)
Performance
Dimetrodon performance summary: energy systems and the evolution of an ecological community design process, 11:11445 (R;US)
Technology Assessment
Displacement of industrial oil consumption in developing countries by wood fuel technologies, 11:11148 (RA;PR)
WOOD FUELS
Use of this term is limited to policy, feasibility, and socio-economic studies. For wood properties use WOOD.
Commercialization
Identifying barriers to the commercialization of low-Btu gasifiers, 11:11144 (R;US)
Domestic Supplies
Firewood versus alternatives: domestic fuel in Mexico. Occasional paper, 11:11150 (R;GB)
Fuel Substitution
Industrial wood energy feasibility studies, 11:11149 (RA;PR)
Gasification
Identifying barriers to the commercialization of low-Btu gasifiers, 11:11144 (R;US)
WOOD PRODUCTS INDUSTRY
Air Pollution
Modeling and testing of formaldehyde emission characteristics of pressed-wood products. Reports XII, XIII, and XIV to the US Consumer Product Safety Commission, 1985, 11:11868 (R;US)
WOOD WASTES
Energy Source Development
Opportunities for biomass energy projects in the State of California, 11:11124 (RA;PR)
WORK FUNCTIONS
Calculation Methods
Sulfur effects in multimetallic Fischer-Tropsch catalysts. Quarterly technical progress report, January 16-April 15, 1985, 11:11131 (R;US)
WORKERS
See PERSONNEL
WORKING (MATERIALS)
See MATERIALS WORKING
WORMS (FLAT)
See PLATYHELMINTHS
WPPSS NUCLEAR PROJECT NO. 1
See WNP-1 REACTOR
WWER TYPE REACTORS
See also PAKS-1 REACTOR
WWER-3 REACTOR
WWER-5 REACTOR
Data Processing
Information flow; a data bank preparation in nuclear power plant reliability information system, 11:11250 (RA;CS;In Czech)
Decontamination
Decontamination of nuclear power plant equipment, 11:11718 (RA;CS;In Czech)
District Heating
Requirements for designing large district heating systems with respect to operating reliability, 11:11319 (RA;CS;In Czech)
ECCS
Monte Carlo simulation assessment of emergency core cooling system reliability of nuclear power plants, 11:11317 (RA;CS;In Czech)
Fault Tree Analysis
Computer-aided reliability analysis of complex systems, 11:11253 (RA;CS;In Czech)
Information Systems
Information flow; a data bank preparation in nuclear power plant reliability information system, 11:11250 (RA;CS;In Czech)
Power Systems
Requirements for designing large district heating systems with respect to operating reliability, 11:11319 (RA;CS;In Czech)
Reactor Control Systems
Guidelines for reliability analysis of control elements and systems of nuclear power plants, 11:11276 (RA;CS;In German)

Reliability
Computer-aided reliability analysis of complex systems, 11:11253 (RA;CS;In Czech)
Information flow; a data bank preparation in nuclear power plant reliability information system, 11:11250 (RA;CS;In Czech)
Steam Turbines
Steam turbines and reliability, 11:11245 (RA;CS;In Czech)
WWER-1000 REACTOR
See WWER-5 REACTOR
WWER-3 REACTOR
ECCS
Improving spray system reliability, 11:11321 (RA;CS;In Russian)
Information Systems
Reliability information system for conventional and nuclear power plants, 11:11217 (RA;CS;In Czech)
Pressure Vessels
Statistical approach to safety assessment of WWER reactor pressure vessels, 11:11318 (RA;CS;In Czech)
Reactor Safety
Improving spray system reliability, 11:11321 (RA;CS;In Russian)
Statistical approach to safety assessment of WWER reactor pressure vessels, 11:11318 (RA;CS;In Czech)
Reliability
Improving spray system reliability, 11:11321 (RA;CS;In Russian)
Reliability information system for conventional and nuclear power plants, 11:11217 (RA;CS;In Czech)
Statistical approach to safety assessment of WWER reactor pressure vessels, 11:11318 (RA;CS;In Czech)
Stress Analysis
Statistical approach to safety assessment of WWER reactor pressure vessels, 11:11318 (RA;CS;In Czech)
WWER-440 REACTOR
See WWER-3 REACTOR
WWER-5 REACTOR
Information Systems
Reliability information system for conventional and nuclear power plants, 11:11217 (RA;CS;In Czech)
Reliability
Optimization of reliability and quality of power sources in power systems, 11:11244 (RA;CS;In Russian)
Reliability information system for conventional and nuclear power plants, 11:11217 (RA;CS;In Czech)
WWER-500 REACTOR
See WWER-5 REACTOR
WYOMING
Slurry Pipelines
Western Resource Transport project: a liquid carbon dioxide/coal slurry pipeline, 11:10850 (RA;US)

X

XENON
Adducts
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
Charged-Particle Transport
Stopping and energy deposition of hadrons in target nuclei, 11:12383 (R;SU)
Dimers
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
Multi-Photon Processes
Kinetic studies following state selective laser excitation. Progress report, March 15, 1985-March 14, 1986, 11:12078 (R;US)
Photoionization
Photoionization studies of HgKr and HgXe, 11:12095 (J;US)
Pion Minus Reactions
Correlations of emission frequency of $\pi 0$ mesons and proton produced in collisions of protons and π^0 mesons with xenon nuclei within the 2-9 GeV energy range and a problem of slow π^0 meson absorption in a target nucleus, 11:12161 (R;SU;In Russian)
Proton Reactions
Correlations of emission frequency of π^0 mesons and proton produced in collisions of protons and π^0 mesons with xenon nuclei within the 2-9 GeV energy range and a problem of slow π^0 meson absorption in a target nucleus, 11:12161 (R;SU;In Russian)
X-RASERS
See X-RAY LASERS
X-RAY FLUORESCENCE ANALYSIS
Meetings
Proceedings of the third meeting on nuclear analysis, 11:11623 (R;DD;In English, German and Russian)
X-RAY LASERS
Design
[Glass Development Laser (GDL) Facility upgrade.] LLE Review. Quarterly report, October-December 1984. Volume 21, 11:12487 (R;US)
Optical Pumping
Spectroscopy of Ldagger-series transitions for x-ray laser photopumping, 11:11760 (J;US)
Research Programs
Energy and Technology Review, 11:11758 (R;US)
Laser Program annual report 1984, 11:12505 (R;US)
X-RAY SPECTROMETERS
Microchannel Electron Multipliers
Performance of a grazing incidence spectrometer system employing a position sensitive microchannel plate detector for beam-foil measurements, 11:11816 (RA;US)
Microprocessors
IBM PC-based spectrometer control system, 11:11817 (RA;US)
Position Sensitive Detectors
Performance of a grazing incidence spectrometer system employing a position sensitive microchannel plate detector for beam-foil measurements, 11:11816 (RA;US)
XYLANASE
Enzyme Activity
Xylanase action on alfalfa cell walls, 11:11928 (RA;US)
Gas Chromatography
Xylanase action on alfalfa cell walls, 11:11928 (RA;US)
XYLANASES
See XYLANASE
XYLENES
Labelling
Mechanism of tritium-atom promoted isotope exchange in the benzene ring. 2. Substituent effects and a crossover in labelling mechanism, 11:11693 (J;US)

Y

YANG-MILLS THEORY
SU-2 Groups
QCD Hamiltonian in the polar representation, 11:12244 (R;SU)
Supergravity
Anomaly freedom in chiral supergravities (6, 8 and 10 dimensions), 11:12230 (R;IT)
Coupling of Yang-Mills to N=4, d=4 supergravity, 11:12229 (R;IT)
YTTERBIUM
Ion-Atom Collisions
L-shell X-ray production cross sections in Nd, Gd, Ho, Yb, Au and Pb for 25-MeV carbon and 32-MeV oxygen ions, 11:12110 (J;NL)
YTTERBIUM 160
High Spin States
Collectivity of ^{160,161}Yb at high spin, 11:12120 (J;US)
YTTERBIUM 161
High Spin States
Collectivity of ^{160,161}Yb at high spin, 11:12120 (J;US)

YTTERBIUM 171
Shell Models
Fragmentation of subshells in rare earth nuclei, 11:12337 (R;SU;In Russian)
Strength Functions
Fragmentation of subshells in rare earth nuclei, 11:12337 (R;SU;In Russian)
YTTERBIUM 174 TARGET
Neutron Reactions
Correlation between the partial cross sections for the $^{174}Yb(n,2\gamma)^{175}Yb$ and $^{176}Yb(d,t)^{175}Yb$ reactions, 11:12335 (R;SU;In Russian)
YTTERBIUM 176 TARGET
Deuteron Reactions
Correlation between the partial cross sections for the $^{174}Yb(n,2\gamma)^{175}Yb$ and $^{176}Yb(d,t)^{175}Yb$ reactions, 11:12335 (R;SU;In Russian)
YTTERBIUM COMPOUNDS
Chemical Preparation
Preparation of $Yb[N(SiMe_3)_2]_2[AiMe_3]_3$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
Crystal Structure
Preparation of $Yb[N(SiMe_3)_2]_2[AiMe_3]_3$. Complex with four Yb-Me-Al interactions, 11:11663 (J;US)
YTTRIUM 89 TARGET
Carbon 12 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
YTTRIUM ALLOYS
Magnetic Specific Heat
Calorimetric investigation of the Y-Er magnetic phase diagram, 11:11505 (R;FR)
YTTRIUM ALUMINIUM GARNETS
See ALUMINIUM OXIDES
YTTRIUM OXIDES
Phase Studies
Analytical electron microscopy studies of precipitation in ceramic systems, 11:11558 (R;US)
YUCCA MOUNTAIN
Geology
Geohydrology of rocks penetrated by test well USW H-4, Yucca Mountain, Nye County, Nevada, 11:11040 (R;US)
Hydrology
Geohydrology of rocks penetrated by test well USW H-4, Yucca Mountain, Nye County, Nevada, 11:11040 (R;US)
Topography
Topographic maps of Yucca Mountain area, Nye County, Nevada, 11:12031 (R;US)

Z

ZEOLITES
Catalytic Effects
FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report, 11:11130 (R;US)
Infrared Spectra
FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report, 11:11130 (R;US)
Ion Exchange
FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report, 11:11130 (R;US)
Thermodynamic Properties
Study of solar solid adsorption ice-maker using 13 X zeolite - water couple in tropical climate, 11:11181 (RA;PR)
ZERO POWER REACTORS
Rossi Alpha Method
Rossi Alpha Method, 11:11284 (R;US)
ZINC
Electrochemistry
Optical and electrochemical study of model zinc electrode pores in alkaline electrolyte, 11:11699 (R;US)
ZINC 64 TARGET
Carbon 12 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
Neon 20 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
ZINC 66 TARGET
Carbon 12 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
ZINC 68 TARGET
Argon 40 Reactions
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
Carbon 12 Reactions
Direct measurements of heavy ion total reaction cross sections at 30 and 83 MeV/nucleon, 11:12302 (R;FR)
ZINC IONS
Electron-Ion Collisions
Electron collisions with positive ions. Progress report, April 1, 1985-March 31, 1986, 11:12079 (R;US)
ZINC OXIDES
Catalytic Effects
Novel experimental studies for coal liquefaction. Quarterly progress report, July 1-September 30, 1985, 11:11142 (R;US)
Sorptive Properties
High-pressure study of rhodamine B in solution and adsorbed on oriented single-crystal ZnO, 11:11690 (J;US)
ZINC SILICATES
Surface Properties
Local structure of metal atoms in silica and silicates. Progress report, May 15-December 1, 1985, 11:11578 (R;US)
ZIRCONIUM
Crack Propagation
Hydrogen-induced cracking: 2. Effect of stress on nucleation, growth and coarsening of zirconium hydride precipitates, 11:11504 (R;CA)
Electronic Structure
Multi-scattering-Xα method for analysis of the electronic structure of atomic clusters (MSXALPHA code), 11:12063 (R;CA)
Hydridation
Hydrogen-induced cracking: 2. Effect of stress on nucleation, growth and coarsening of zirconium hydride precipitates, 11:11504 (R;CA)
Thermal Stresses
Hydrogen-induced cracking: 2. Effect of stress on nucleation, growth and coarsening of zirconium hydride precipitates, 11:11504 (R;CA)
ZIRCONIUM 90
Moment of Inertia
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
Rotational States
Mass dependence of shell effects at high rotational frequencies, 11:12321 (J;NL)
ZIRCONIUM 90 TARGET
Electron Reactions
Possibility of excitation twist mode selection in the (e, e') reaction, 11:12330 (R;SU;In Russian)
ZIRCONIUM 96
Nuclear Deformation
Deformation and shape coexistence in medium mass nuclei, 11:12332 (J;NL)
ZIRCONIUM 99
Nuclear Deformation
Deformation and shape coexistence in medium mass nuclei, 11:12332 (J;NL)
ZIRCONIUM ALLOYS
See also ZIRCONIUM BASE ALLOYS
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)

Physical Radiation Effects
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
Plasticity
Superplastic properties of an Al-Cu-Li-Zr alloy, 11:11542 (J;GB)

ZIRCONIUM BASE ALLOYS
Crack Propagation
Hydrogen-induced cracking: 2. Effect of stress on nucleation, growth and coarsening of zirconium hydride precipitates, 11:11504 (R;CA)
Hydridation
Hydrogen-induced cracking: 2. Effect of stress on nucleation, growth and coarsening of zirconium hydride precipitates, 11:11504 (R;CA)
Physical Radiation Effects
Effect of irradiation and irradiation temperature on the fracture toughness of cold-worked Zr-2.5 wt percent Nb, 11:11503 (R;CA)
Sorptive Properties
Experimental investigation of the rate of hydrogen absorption in zirconium-2.5 wt percent niobium from steam/hydrogen mixtures at elevated temperatures. Test specifications, 11:11649 (R;CA)
Thermal Stresses
Hydrogen-induced cracking: 2. Effect of stress on nucleation, growth and coarsening of zirconium hydride precipitates, 11:11504 (R;CA)

ZIRCONIUM OXIDES
Chemical Properties
Ion exchange characteristics of hydrous oxides and their use in the separation of uranium and thorium, 11:11612 (RA;XA)
Interfaces
Analytical electron microscopy studies of precipitation in ceramic systems, 11:11558 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
Phase Studies
Analytical electron microscopy studies of precipitation in ceramic systems, 11:11558 (R;US)
Physical Radiation Effects
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)

ZIRCONIUM PHOSPHATES
Chemical Radiation Effects
Effect of gamma radiation on various inorganic ion exchangers, 11:11712 (RA;XA)

ZIRCONIUM SILICATES
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
Physical Radiation Effects
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)

ZIRCONIUM SILICIDES
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)
Physical Radiation Effects
Effect of the chemical environment on the L and M heavy-ion-induced X-ray satellite emission spectra, 11:12115 (J;NL)

ZOOPLANKTON
Abundance
Biological processes in the water column of the South Atlantic Bight: zooplankton responses. Progress report, June 1985-June 1986, 11:11906 (R;US)
Spatial Distribution
Biological processes in the water column of the South Atlantic Bight: zooplankton responses. Progress report, June 1985-June 1986, 11:11906 (R;US)

CONTRACT NUMBER INDEX

Numbers assigned to DOE contracts under which documents announced in this publication were prepared are included in this index.

Contract No.	Abstract No.	Report No.
AC01-79CS20524	**Winter (Steven) Associates, Inc., New York (USA)**	
	11:11443	DOE/CS/20524—7
AC01-80ER52068	**Supercon, Inc., Shrewsbury, MA (USA)**	
	11:11514	DOE/ER/52068—T10
	Supercon, Inc., Natick, MA (USA)	
	11:11515	DOE/ER/52068—T11
AC01-80ET17086	**Energy Resources Co., Inc., Cambridge, MA (USA)**	
	11:10735	DOE/ET/17086—1932
AC01-80RA50423	**Advanced Information and Decision Systems, Mountain View, CA (USA)**	
	11:11210	AI/DS/TR—1010-1
AC01-84CE50043	**Mechanical Technology, Inc., Latham, NY (USA)**	
	11:11489	DOE/CE/50043—1
AC01-84CE50070	**Southwest Research Inst., San Antonio, TX (USA). Fuels and Lubricants Research Div.**	
	11:11502	DOE/CE/50070—T6
AC01-84EI19658	**Orkand Corp., Silver Spring, MD (USA)**	
	11:11392	DOE/EI/19658—1
AC01-84ER30063	**Mueller Associates, Inc., Baltimore, MD (USA)**	
	11:11458	DOE/ER/30063—T1-Vol.1
	11:11459	DOE/ER/30063—T2-Vol.2-App.
	11:11460	DOE/ER/30063—T3-Vol.3
AC01-85PE77000	**Energy and Environmental Analysis, Inc., Arlington, VA (USA)**	
	11:11461	DOE/PE/77000—1
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	11:10959	BNL—37377
	11:10960	BNL—37399
	11:11025	NUREG/CR—2482-Vol.8
	11:11114	BNL—37296
	11:11119	BNL—36756
	11:11120	BNL—51940
	11:11225	BNL-NUREG—37186
	11:11234	NUREG/CR—4292
	11:11291	BNL-NUREG—36985
	11:11292	BNL-NUREG—36986
	11:11293	BNL-NUREG—36987
	11:11294	BNL-NUREG—36988
	11:11295	BNL-NUREG—36989
	11:11296	BNL-NUREG—37004
	11:11297	BNL-NUREG—37005
	11:11298	BNL-NUREG—37324
	11:11329	NUREG/CR—4103
	11:11332	NUREG/CR—4329
	11:11334	NUREG/CR—4364
	11:11336	NUREG/CR—4400
	11:11398	Energy (Oxford) 10 NO. 5. 635-641 (1985).
	11:11412	BNL—51871
	Battelle Columbus Labs., OH (USA)	
	11:11413	BNL—51943
	11:11531	Journal of Applied Physics 59 NO. 3. 840-853 (1 Feb 1986).
	11:11567	Journal of the Less-Common Metals 89 505-512 (1983).
AC02-76CH03000	**Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering**	
	11:11573	BNL—37301
	11:11679	Journal of Physical Chemistry 89 NO. 18. 3814-3818 (29 Aug 1985).
	11:11686	Journal of Physical Chemistry 89 NO. 14. 2969-2972 (4 Jul 1985).
	11:11701	Molecular Crystals and Liquid Crystals 121 291-295 (1985).
	Harvard Medical School, Boston, MA (USA)	
	11:11717	IAEA-SM—247/19
	Brookhaven National Lab., Upton, NY (USA)	
	11:11783	BNL—37310
	11:11789	BNL—51927
	11:11792	BNL—37156
	11:11793	BNL—37314
	11:11965	BNL—37327
	11:11980	Medical Physics 13 NO. 1. 45-49 (Jan 1986).
	11:11981	Medical Physics 13 NO. 1. 50-56 (Jan 1986).
	11:12010	Proceedings of the Society for Experimental Biology and Medicine 179 NO. 4. 522-528 (Sep
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AC02-76ET34215	**Exxon Nuclear Co., Inc., Richland, WA (USA)**	
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AC02-81ER60005	**Pittsburgh Univ., PA (USA)**	
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Contract No.	Abstract No.	Report No.
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AC02-82ER52082	**Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering**	
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AC02-83CH10093	**Delaware Univ., Newark (USA). Inst. of Energy Conversion**	
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	Solarex Corp., Newtown, PA (USA)	
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	Chronar Corp., Princeton, NJ (USA)	
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	Colorado State Univ., Fort Collins (USA). Dept. of Physics	
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	Massachusetts Inst. of Tech., Lexington (USA)	
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AC02-83ER80010	**Eltron Research, Inc., Naperville, IL (USA)**	
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Contract No.	Abstract No.	Report No.
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	Brown (Omer F. II), Washington, DC (USA)	
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	D'Appolonia Consulting Engineers, Albuquerque, NM (USA)	
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AC05-76ER01067	**Triangle Universities Nuclear Lab., Durham, NC (USA)**	
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AC05-76ER04014	**Florida Univ., Gainesville (USA). Dept. of Nuclear Engineering Sciences**	
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Contract No.	Abstract No.	Report No.
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AC05-85OR21558	**Battelle Columbus Labs., OH (USA)**	
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AC06-76FF02170	**Hanford Engineering Development Lab., Richland, WA (USA)**	
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AC06-76RL01830	**Pacific Northwest Labs., Richland, WA (USA)**	
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Contract No.	Abstract No.	Report No.
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AC06-84ER40124	**Washington Univ., Seattle (USA). Nuclear Physics Lab.**	
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AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls (USA)**	
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AC07-84ID12532	**Thermo Electron Corp., Waltham, MA (USA)**	
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AC08-80DP40124	**Rochester Univ., NY (USA)**	
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AC08-83NV10282	**EG and G Energy Measurements, Inc., Goleta, CA (USA). Santa Barbara Operations**	
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Contract No.	Abstract No.	Report No.
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AC15-76CL02395	**Westinghouse Electric Corp., Madison, PA (USA)**	
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AC21-84MC21119	**Tulsa Univ., OK (USA). Dept. of Mechanical Engineering**	
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AC22-83PC60046	**Gulf South Research Inst., New Orleans, LA (USA)**	
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AC22-83PC60415	**USDOE Pittsburgh Energy Technology Center, PA**	
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AC22-83PC62999	**Cincinnati Univ., OH (USA). Kettering Lab.**	
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AC22-84PC70018	**Conoco, Inc., Library, PA (USA). Coal Research Div.**	
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AC22-84PC70768	**United Technologies Research Center, East Hartford, CT (USA)**	
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AC22-85PC81003	**Ceramatec, Inc., Salt Lake City, UT (USA)**	
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AC22-85PC81205	**Bechtel National, Inc., San Francisco, CA (USA)**	
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AI01-77CS51040	**IIT Research Inst., Chicago, IL (USA)**	
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AI01-80CS50194	**Massachusetts Inst. of Tech., Cambridge (USA). Sloan Automotive Lab.**	
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AI01-85CE50112	**General Electric Co., Philadelphia, PA (USA). Space Systems Div.**	
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AI21-80ET17088	**United Technologies Corp., South Windsor, CT (USA). Power Systems Div.**	
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AM03-76SF00893	**General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.**	
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AS05-83ER60149	**Maryland Univ., College Park (USA). Dept. of Meteorology**	
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FC02-80CS30522	Four Seasons Solar Products Corp., Farmingdale, NY (USA)	
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FC05-77ET10069	Exxon Research and Engineering Co., Annandale, NJ (USA)	
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FC07-80ID12117	New York State Electric and Gas Corp., Binghamton (USA)	
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FC07-80ID12129	Shoshone Irrigation District, Powell, WY (USA)	
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FC21-83FE60181	North Dakota Univ., Grand Forks (USA). Energy Research Center	
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FG02-84ER45057	Ohio State Univ., Columbus (USA). Dept. of Welding Engineering	
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FG02-84ER45059	Department of Physics, The University of Michigan, Ann Arbor, Michigan 48109	
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FG03-81ER10250	Hawaii Univ., Honolulu (USA). Hawaii Natural Energy Inst.	
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Contract No.	Abstract No.	Report No.
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FG05-84ER13191	**Texas Univ., Austin (USA). Dept. of Physics**	
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FG05-84ER13192	**Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy**	
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FG05-84ER45072	**Virginia Univ., Charlottesville (USA). Dept. of Physics**	
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FG05-84ER45078	**Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Ceramics**	
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FG09-85ER60351	**Skidaway Inst. of Oceanography, Savannah, GA (USA)**	
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FG09-85ER60354	**Skidaway Inst. of Oceanography, Savannah, GA (USA)**	
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FG22-83PC60798	**Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering**	
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FG22-83PC60801	**California Inst. of Tech., Pasadena (USA)**	
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FG22-84PC70788	**Notre Dame Univ., IN (USA). Dept. of Chemical Engineering**	
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FG22-84PC70800	**West Virginia Univ., Morgantown (USA). Dept. of Physics**	
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	11:10799	DOE/PC/70809—T4
FG22-84PC70812	**Wyoming Univ., Laramie (USA). Dept. of Chemical Engineering**	
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FG22-84PC70814	**Alabama Univ., Huntsville (USA)**	
	11:10786	DOE/PC/70814—5
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FG22-85PC81504	**Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering**	
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FG41-79R110004	**Dimetrodon Research Station, Warren, VT (USA)**	
	11:11445	DOE/R1/10004—T1
W-31-109-ENG-38	**Argonne National Lab., IL (USA)**	
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	11:11389	CONF-860205—3
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Contract No.	Abstract No.	Report No.
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	Los Alamos National Lab., NM (USA)	
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	11:12282	LA-UR—85-2991
	11:12372	LA-UR—85-3733
	11:12384	LA-UR—85-4335
	11:12420	LA-UR—85-4262
	11:12421	LA-UR—85-4265
	11:12495	LA-UR—85-3988
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	Lawrence Livermore National Lab., CA (USA)	
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	11:12505	UCRL—50021-84
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REPORT NUMBER INDEX

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796	NTIS (US Sales Only), PC A02/MF A01	DE86780329	MN -20	11:12472
AD-				
349263/ 4/ XAB	NTIS, PC A09/MF A01			11:11852
420340/ 2/ XAB	NTIS, PC A04/MF A01			11:11918
AD-A-				
157717/ 0/ XAB	NTIS, PC A04/MF A01			11:11986
157729/ 5/ XAB	NTIS, PC A02/MF A01			11:12059
157791/ 5/ XAB	NTIS, PC A02/MF A01			11:11987
157808/ 7/ XAB	NTIS, PC A02/MF A01			11:11853
157825/ 1/ XAB	NTIS, PC A02/MF A01			11:11988
157826/ 9/ XAB	NTIS, PC A02/MF A01			11:11989
157832/ 7/ XAB	NTIS, PC A06/MF A01			11:12053
157885/ 5/ XAB	NTIS, PC A02/MF A01			11:11990
157930/ 9/ XAB	NTIS, PC A03/MF A01			11:12054
157940/ 8/ XAB	NTIS, PC A02/MF A01			11:11638
157945/ 7/ XAB	NTIS, PC A02/MF A01			11:11361
157984/ 6/ XAB	NTIS, PC A02/MF A01			11:11991
158046/ 3/ XAB	NTIS, PC A02/MF A01			11:11984
158054/ 7/ XAB	NTIS, PC A09/MF A01			11:10930
158061/ 2/ XAB	NTIS, PC A02/MF A01			11:12060
158066/ 1/ XAB	NTIS, PC A02/MF A01			11:11992
158094/ 3/ XAB	NTIS, PC A04/MF A01			11:11762
158096/ 8/ XAB	NTIS, PC A14/MF A01			11:11914
158282/ 4/ XAB	NTIS, PC A06/MF A01			11:11639
158333/ 5/ XAB	NTIS, PC A02/MF A01			11:11670
158378/ 0/ XAB	NTIS, PC A02/MF A01			11:12061
158387/ 1/ XAB	NTIS, PC A02/MF A01			11:11602
158390/ 5/ XAB	NTIS, PC A05/MF A01			11:11854
158400/ 2/ XAB	NTIS, PC A02/MF A01			11:12062
158402/ 8/ XAB	NTIS, PC A02/MF A01			11:11640
158425/ 9/ XAB	NTIS, PC A02/MF A01			11:11411
158442/ 4/ XAB	NTIS, PC A06/MF A01			11:11728
158514/ 0/ XAB	NTIS, PC A05/MF A01			11:11457
158560/ 3/ XAB	NTIS, PC A02/MF A01			11:11729
158598/ 3/ XAB	NTIS, PC A04/MF A01			11:11387
158692/ 4/ XAB	NTIS, PC A07/MF A01			11:11730
158759/ 1/ XAB	NTIS, PC A02/MF A01			11:11571
158772/ 4/ XAB	NTIS, PC A03/MF A01			11:11603
158792/ 2/ XAB	NTIS, PC A02/MF A01			11:11780
158804/ 5/ XAB	NTIS, PC A03/MF A01			11:11782
158824/ 3/ XAB	NTIS, PC A02/MF A01			11:11731
158832/ 6/ XAB	NTIS, PC A05/MF A01			11:11572
158855/ 7/ XAB	NTIS, PC A03/MF A01			11:11374
158859/ 9/ XAB	NTIS, PC A04/MF A01			11:11781
158912/ 6/ XAB	NTIS, PC A02/MF A01			11:11388
158931/ 6/ XAB	NTIS, PC A03/MF A01			11:11732
AD-P-				
004920/ 5/ XAB	NTIS, PC A02/MF A01			11:11733

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
004957/ 7/ XAB	NTIS, PC A03/MF A01				11:11855
AECL-					
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8184	NTIS (US Sales Only), PC A02/MF A01		DE86700453	MN -34C	11:12347
8256	NTIS (US Sales Only), PC A02/MF A01		DE86700472	MN -86	11:10978
8368	NTIS (US Sales Only), PC A03/MF A01		DE86700476	MN -25	11:11503
8381	NTIS (US Sales Only), PC A03/MF A01		DE86700477	MN -25	11:11504
8631	*See* CFFTP-G-84033		DE86700361	MN -20	11:12476
AEEW-R-					
1878	*See* SRDP-R-119		DE86701203	MN -16	11:11084
1977	NTIS (US Sales Only), PC A04/MF A01		DE86701195	MN -70	11:10994
AERE-R-					
11439	Issuing Activity				11:12323
11566	H.M. Stationery Office, London, price Pound 5.00			MN -70	11:10995
11753	H.M. Stationery Office, London, price Pound 4.00			MN -70	11:10996
AFIT-CI-					
NR-85-87T	*See* AD-A-158094/3/XAB				11:11762
NR-85-99T	*See* AD-A-158096/8/XAB				11:11914
AI/DS/TR-					
1010-1	NTIS, PC A09/MF A01 (GPO Dep.)	E 1.99:	DE86004773	MN -97	11:11210
ANAEM-FR-					
84	NTIS (US Sales Only), PC A04/MF A01		DE86701208	MN -2	11:12268
ANL-					
85-39	*See* DOE/MC/49941-1833	E 1.99:	DE86004295	STD -93A	11:11408
85-70	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005120	STD -32	11:12517
ANL/EES-TM-					
292	NTIS PC E06/MF A01 (GPO Dep.)	E 1.99:	DE86004965	MN -70	11:10997
ANL/FE-					
85-9	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005523	STD -90c	11:11552
ANL-HEP-CP-					
85-103	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86003061	MN -34C	11:12356
ANL/MCS-TM-					
60	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004966	MN -32	11:12518
ANL/OEPM-					
85-4	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004178	MN -94ca	11:11362
ANL/SPG-					
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ANU-P-					
904	NTIS (US Sales Only), PC A02/MF A01		DE86700438	MN -34C	11:12310
905	NTIS (US Sales Only), PC A03/MF A01		DE86700450	MN -34C	11:12340
908	NTIS (US Sales Only), PC A03/MF A01		DE86700439	MN -34C	11:12311
909	NTIS (US Sales Only), PC A02/MF A01		DE86700446	MN -34C	11:12333
915	NTIS (US Sales Only), PC A02/MF A01		DE86700451	MN -34C	11:12341
926	NTIS (US Sales Only), PC A02/MF A01		DE86700443	MN -34C	11:12326
ANU-PRL-					
84/ 4	NTIS (US Sales Only), PC A02/MF A01		DE86701200	MN -2	11:12473
ARL/TR-					
068	NTIS (US Sales Only), PC A02/MF A01		DE86700457	MN -4	11:12388
070	NTIS (US Sales Only), PC A04/MF A01		DE86700483	MN -51	11:11898
ARR-					
18	*See* AD-A-157717/0/XAB				11:11986
BCRNL-L-					
1525	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005005	MN -90b	11:10825
BHARC-					
400/ 85/ 013	*See* NUREG/CR-4378		TI86005112	MN -80	11:11335
BM-IC-					
9009	*See* PB-85-235786/XAB				11:10923
9017	*See* PB-85-236479/XAB				11:10925
9019	*See* PB-85-236453/XAB				11:10924
9020	*See* PB-85-239986/XAB				11:10824
9027	*See* PB-85-237923/XAB				11:10811
BMI-					
2133	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004530	MN -25	11:11553
BMI/ONWI-					
569	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE86004664	STD -70	11:10998
BNL-					
36756	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86002503	MN -94d	11:11119
37156	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86003380	MN -28	11:11792
37162	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86003381	MN -34C	11:12327
37221	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004355	MN -32	11:12519
37234	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005052	MN -34D	11:12140
37294	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005051	MN -34D	11:12141
37296	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005057	MN -34A	11:11114
37301	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005056	MN -25	11:11573
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37316	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005050	MN -34	11:12036
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37399	NTIS, PC A02; 3		DE86005248	MN -92	11:10960
51871	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005293	STD -93d	11:11412
51927	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005303	STD -28	11:11789

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
51940	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE86005300	STD -93	11:11120
51943	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99: DE86004833	STD -95d	11:11413
BNL-NUREG-				
36985	NTIS, PC A02/MF A01 - GPO	TI86001170	MN -78	11:11291
36986	NTIS, PC A02/MF A01 - GPO	TI86001190	MN -78	11:11292
36987	NTIS, PC A02/MF A01 - GPO	TI86000632	MN -78	11:11293
36988	NTIS, PC A02/MF A01 - GPO	TI86001171	MN -80	11:11294
36989	NTIS, PC A02/MF A01 - GPO	TI86001189	MN -78	11:11295
37004	NTIS, PC A02/MF A01 - GPO	TI86001200	MN -78	11:11296
37005	NTIS, PC A02/MF A01 - GPO	TI86001199	MN -78	11:11297
37186	NTIS, PC A03/MF A01 - GPO	TI86003376	MN -78	11:11225
37324	NTIS, PC A02/MF A01 - GPO	TI86004357	MN -78	11:11298
51494-Vol.8	*See* NUREG/CR-2482-Vol.8	TI86005240	MN -70	11:11025
51849	*See* NUREG/CR-4103	TI86004006	MN -80	11:11329
51898	*See* NUREG/CR-4292	TI86001821	MN -78	11:11234
51906	*See* NUREG/CR-4329	TI86004934	MN -80	11:11332
51912	*See* NUREG/CR-4364	TI86004031	MN -41	11:11334
51928	*See* NUREG/CR-4400	TI86004714	MN -78	11:11336
BRGM-				
83-SGN-885-IRG	NTIS (US Sales Only), PC A03/MF A01; 1	DE86750439	MN -66a	11:11202
84-SGN-143-GTH	NTIS (US Sales Only), PC A02/MF A01; 1	DE86750435	MN -66b	11:11203
CBPF-NF-				
001/ 84	NTIS (US Sales Only), PC A03/MF A01	DE86700382	MN -34D	11:12178
003/ 84	NTIS (US Sales Only), PC A02/MF A01	DE86700362	MN -34B	11:12037
004/ 84	NTIS (US Sales Only), PC A02/MF A01	DE86700330	MN -34D	11:12218
005/ 84	NTIS (US Sales Only), PC A02/MF A01	DE86700363	MN -34B	11:12038
007/ 84	NTIS (US Sales Only), PC A02/MF A01	DE86700331	MN -34D	11:12219
008/ 84	NTIS (US Sales Only), PC A04/MF A01	DE86700462	MN -4	11:11641
009/ 84	NTIS (US Sales Only), PC A02/MF A01	DE86700370	MN -34D	11:12179
029/ 84	NTIS (US Sales Only), PC A02/MF A01	DE86700351	MN -34A	11:12395
030/ 84	NTIS (US Sales Only), PC A02/MF A01	DE86700332	MN -34D	11:12220
032/ 84	NTIS (US Sales Only), PC A03/MF A01	DE86700333	MN -34D	11:12221
034/ 84	NTIS (US Sales Only), PC A02/MF A01	DE86700371	MN -34D	11:12180
035/ 84	NTIS (US Sales Only), PC A02/MF A01	DE86700383	MN -34D	11:12181
041/ 84	NTIS (US Sales Only), PC A02/MF A01	DE86700384	MN -34D	11:12222
073/ 83	NTIS (US Sales Only), PC A02/MF A01	DE86700410	MN -34C	11:11794
CEA-CONF-				
7160	NTIS (US Sales Only), PC A02/MF A01; 1	DE86750440	MN -61G	11:11157
7344	NTIS (US Sales Only), PC A02/MF A01	DE86750329	MN -78	11:11275
7345	NTIS (US Sales Only), PC A02/MF A01	DE86750330	MN -78	11:11286
7420	NTIS (US Sales Only), PC A02/MF A01	DE86750364	MN -34C	11:11115
7509	NTIS (US Sales Only), PC A02/MF A01	DE86750362	MN -34C	11:12328
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7684	NTIS (US Sales Only), PC A03/MF A01	DE86750385	MN -83	11:11080
7686	NTIS (US Sales Only), PC A02/MF A01	DE86750388	MN -10	11:10983
7691	NTIS (US Sales Only), PC A02/MF A01	DE86750354	MN -20d	11:12474
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7705	NTIS (US Sales Only), PC A02/MF A01	DE86750383	MN -83	11:11605
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7709	NTIS (US Sales Only), PC A02/MF A01	DE86750365	MN -37	11:12426
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7778	NTIS (US Sales Only), PC A02/MF A01	DE86750361	MN -25	11:11574
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7833	NTIS (US Sales Only), PC A02/MF A01	DE86750322	MN -86	11:10987
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7895	NTIS (US Sales Only), PC A02/MF A01; 1	DE86750441	MN -95d	11:11575
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2411-Vol.1	NTIS (US Sales Only), PC A10/MF A01	DE86750389	MN -34C	11:12273
CENBG-				
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85-159	NTIS (US Sales Only), PC A02/MF A01	DE86900390	MN -34D	11:12182
85-167	NTIS (US Sales Only), PC A05/MF A01; 1	DE86900394	MN -34D	11:12143
85-168	NTIS (US Sales Only), PC A02/MF A01	DE86900399	MN -34C	11:12295
85-173	NTIS (US Sales Only), PC A02/MF A01; 1	DE86900397	MN -34D	11:12065
85-192	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86004531	MN -34D	11:12144

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
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CFFTP-G-					
84033	NTIS (US Sales Only), PC A14/MF A01		DE86700361	MN -20	11:12476
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23	*See* PB-85-235380/XAB				11:11150
25	*See* PB-85-235455/XAB				11:10810
CNAEM-FR-					
83	NTIS (US Sales Only), PC A04/MF A01		DE86701209	MN -2	11:12269
CNEA-NT-					
14/ 83	NTIS (US Sales Only), PC A16/MF A01		DE86700465	MN -4	11:11267
CNRS-CPT-					
84-P-1699	NTIS (US Sales Only), PC A06/MF A01		DE86750313	MN -34D	11:12399
84-P-1705	NTIS (US Sales Only), PC A02/MF A01		DE86750391	MN -34B	11:12055
84-P-1709	NTIS (US Sales Only), PC A02/MF A01		DE86750335	MN -34D	11:12400
84-PE-1703	NTIS (US Sales Only), PC A03/MF A01		DE86750351	MN -34B	11:12039
84-PE-1712	NTIS (US Sales Only), PC A02/MF A01		DE86750311	MN -34D	11:12401
CONCAWE-					
1/ 85	*See* PB-85-241164/XAB				11:10954
CONF-570404-	(Symposium on isotope separation, Amsterdam, Netherlands, 22 Apr 1957)				
1	*See* K/OA-226		DE86000318	MN -22	11:11112
CONF-800607-	(American Nuclear Society annual meeting, Las Vegas, NV, USA, 8-13 Jun 1980)				
85	*See* PNL-SA-8261		TI85016694	MN -78	11:11339
CONF-800937-	(International symposium on medical radionuclide imaging, Heidelberg, F.R. Germany, 1-5 Sep 1980)				
4	*See* IAEA-SM-247/19	E 1.99:	DE86005121	MN -48	11:11717
CONF-801056-	(International conference on current nuclear power plant safety issues, Stockholm, Sweden, 26-27 Oct 1980)				
4	*See* SAND-80-0544C		TI85016663	MN -78	11:11343
6	*See* PNL-SA-8477		TI85016693	MN -78	11:11340
CONF-801107-	(ANS international conference, Washington, DC, USA, 17-21 Nov 1980)				
69	*See* PNL-SA-8757		TI85016696	MN -78	11:11237
CONF-810323-	(Symposium in underground siting of nuclear power plants, Hannover, F.R. Germany, 16-20 Mar 1981)				
1	*See* UCRL-84191		TI85016668	MN -78	11:11354
CONF-810333-	(Faculty institute on light water reactor safety-degraded core cooling, Argonne, IL, USA, 16-20 Mar 1981)				
2	*See* SAND-81-0655C		TI85016713	MN -78	11:11346
CONF-810606-	(American Nuclear Society's annual meeting, Miami Beach, FL, USA, 7-12 Jun 1981)				
8	*See* SAND-81-0158C		TI85016666	MN -78	11:11345
9	*See* SAND-81-0123C		TI85016664	MN -78	11:11344
CONF-8106235-	(Workshop on low-rank coal technology development, San Antonio, TX, USA, 17-18 Jun 1981)				
	See DOE/ET/17086-1932	E 1.99:	DE86000823	STD -90	11:10735
CONF-810905-	(ANS/ENS topical meeting on probabilistic risk assessment, Port Chester, NY, USA, 20-24 Sep 1981)				
1	*See* SAND-81-0947C		TI85016712	MN -78	11:11347
CONF-811042-	(9. water reactor safety research information meeting, Washington, DC, USA, 26-28 Oct 1981)				
17	*See* PNL-SA-9938		TI85016716	MN -78	11:11238
21	*See* PNL-SA-9985		TI85016706	MN -78	11:11341
CONF-811068-	(4. conference on water chlorination: environmental impact and health effects, Pacific Grove, CA, USA, 18-23 Oct 1981)				
3	*See* PNL-SA-9585		TI85016715	MN -78	11:11255
CONF-811101-	(Winter annual meeting of the American Society of Mechanical Engineers, Washington, DC, USA, 15-20 Nov 1981)				
5	*See* SAND-81-1101C		TI85016704	MN -78	11:11348
CONF-8111235-	(European conference on non-linear finite element analysis, Hague, Netherlands, 25-26 Nov 1981)				
1	NTIS (US Sales Only), PC A02/MF A01		DE86900360	MN -38	11:11744
CONF-820132-	(ASTM D-34 meeting, Orlando, FL, USA, 28-29 Jan 1982)				
	Am. Soc. Test. Mater., Spec. Tech. Publ., STP-805: 141-151(Jan 1982)				11:11480
CONF-820836-	(NATO advanced study institute on radiation hydrodynamics, Munich, F.R. Germany, 2-13 Aug 1982)				
3	*See* LA-UR-85-4448	E 1.99:	DE86004749	MN -34B	11:12042
CONF-820989-	(Workshop on science underground, Los Alamos, NM, USA, 27 Sep-1 Oct 1982)				
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Report Number	Availability Source	File Number	Distribution Category	Abstract Number
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CONF-821193-	(JAERI seminar on nuclear data, Tokai, Japan, 24-25 Nov 1982)			
	See JAERI-M-83-041	DE83902446	MN -34C	11:12279
CONF-8304171-	(3. meeting on nuclear analysis, Dresden, German D.R., 11-15 Apr 1983)			
	See ZfK-524	DE86700458	MN -4	11:11623
CONF-8305291-	(AIF-FORATOM - internatioanl conference on fuel cycle, Geneva, Switzerland, 31 May 1983)			
1	*See* CEA-CONF-7831	DE86750324	MN -86	11:10985
CONF-830905-	(Joint power generation conference, Indianapolis, IN, USA, 25-29 Sep 1983)			
13	*See* GA-A-17180	TI86900356	MN -77	11:11257
CONF-830948-	(Seminar on technical and environmental aspects of spent fuel management, Madrid, Spain, 26-30 Sep 1983)			
2	*See* CEA-CONF-7832	DE86750323	MN -86	11:10986
CONF-8309144-	(EPS conference on computing in accelerator design and operation, Berlin, F.R. Germany, 20-23 Sep 1983)			
11	*See* TRI-PP-83-95	DE86700311	MN -34D	11:12409
CONF-8309163-	(Conference on low energy tests of conservation laws in particle physics, Blacksburg, VA, USA, 12-14 Sep 1983)			
6	*See* TRI-PP-83-93	DE86700376	MN -34D	11:12206
CONF-8309265-	(IAEA specialists meeting on hydrogen behaviour and control and related containment loading aspects, Suzdal, USSR, 19-23 Sep 1983)			
	See IAEA-TC-427/6	DE86780327	MN -4	11:11644
CONF-8310411-	(Conference on reliability of fossil-fuel and nuclear power installations, Karlovy Vary, Czechoslovakia, 25-27 Oct 1983)			
	See INIS-mf-10008	DE86780347	MN -78	11:11243
CONF-8310414-	(5. forecasting symposium on forecasting in an era of technological change, Boxborough, MA, USA, 18-20 Oct 1983)			
	See EPRI-EA-4031	TI85920825	ND -97c	11:11399
CONF-831265-	(6. international conference on lasers and applications, San Francisco, CA, USA, 12-16 Dec 1983)			
8	*See* CEA-CONF-7160	DE86750440	MN -61G	11:11157
CONF-8402156-	(Meeting of the Science Academy, Paris, France, 6 Feb 1984)			
1	*See* CNRS-CPT-84-PE-1703	DE86750351	MN -34B	11:12039
CONF-8404285-	(Consultants meeting on coordination of the international network of nuclear structure and decay data evaluators, Karlsruhe, F.R. Germany, 3-6 Apr 1984)			
Summ.	*See* INDC(NDS)-157/GE	DE86701204	MN -2	11:12278
CONF-8405193-	(Conference on the intersections between particle and nuclear physics, Steamboat Springs, CO, USA, 23-30 May 1984)			
49	*See* ISN-84-31	DE86750333	MN -78	11:12159
CONF-8405363-	(5. national meeting on intermediate energy physics, Gramado, Brazil, 7-9 May 1984)			
1	*See* IFUSP-P-462	DE86700417	MN -34C	11:12365
CONF-8406123-	(IAEA Technical Committee meeting on inorganic ion exchangers and absorbents for chemical processing in the nuclear fuel cycle, Vienna, Austria, 12-15 Jun 1984)			
	See IAEA-TECDOC-337	DE86700463	MN -4	11:11019
2	*See* CEA-CONF-7776	DE86750381	MN -83	11:11607
CONF-8406129-	(MRS European meeting, Strasbourg, France, 5-8 Jun 1984)			
6	*See* CEA-CONF-7895	DE86750441	MN -95d	11:11575
CONF-8406182-	(11. international conference on neutrino physics and astrophysics, Nordkirchen bei Dortmund, F.R. Germany, 11-16 Jun 1984)			
8	*See* ISN-84-32	DE86750334	MN -78	11:12160
CONF-840734-	(25. annual meeting of the Institute of Nuclear Materials Management, Columbus, OH, USA, 15-18 Jul 1984)			
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Report Number	Availability Source	File Number	Distribution Category	Abstract Number
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	Nucl. Mater. Manage., 13: 29-31(Jul 1984)			11:11086
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	Nucl. Mater. Manage., 13: 60-65(Jul 1984)			11:11088
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	Nucl. Mater. Manage., 13: 162-168(Jul 1984)			11:11103
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CONF-840786-	(9. international conference on atomic physics, Seattle, WA, USA, 23-27 Jul 1984)			
7-Summ.	*See* CENBG-8425	DE86750318	MN -34A	11:12064
CONF-840788-	(International conference on the physics of highly ionized atoms, Oxford, UK, 2-5 Jul 1984)			
5	*See* CENBG-8429	DE86750349	MN -34C	11:12317
CONF-840789-	(International conference on particles and nuclei, Heidelberg, F.R. Germany, 30 Jul-3 Aug 1984)			
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CONF-8407121-	(5. international symposium on surfactants in solution, Bordeaux, France, 9-13 Jul 1984)			
4	*See* CEA-CONF-7559	DE86750363	MN -34C	11:12381
CONF-840842-	(17. international conference on low temperature physics, Karlsruhe, F.R. Germany, 15-22 Aug 1984)			
35-Summ.	*See* CEA-CONF-7777	DE86750350	MN -25	11:11505
CONF-840851-	(2. IMACS symposium on energy modeling and simulation, Upton, NY, USA, 26-29 Aug 1984)			
2	*See* BNL-37377	DE86005247	MN -92	11:10959
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CONF-840883-	(International conference on defects in insulating crystals, Salt Lake City, UT, USA, 20-24 Aug 1984)			
3-Summ.	*See* CEA-CONF-7779	DE86750360	MN -25	11:11554
4-Summ.	*See* CEA-CONF-7778	DE86750361	MN -25	11:11574
CONF-8408123-	(International symposium on nuclear orientation and nuclei far from stability, Leuven, Belgium, 28-31 Aug 1984)			
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1	*See* CEA-CONF-7509	DE86750362	MN -34C	11:12328
CONF-840906-	(Capture gamma-ray spectroscopy conference, Knoxville, TN, USA, 10-14 Sep 1984)			
22	*See* DOE/ER/10452-14	E 1.99: DE86004774	MN -34C	11:12349
CONF-840910-	(10. international conference on plasma physics and controlled nuclear fusion research, London, UK, 12-19 Sep 1984)			
29	*See* CEA-CONF-7792	DE86750359	MN -21	11:12427
CONF-8409150-	(12. world conference of the International Nuclear Target Development Society, Antwerp, Belgium, 25-28 Sep 1984)			
6	*See* CEA-CONF-7420	DE86750364	MN -34C	11:11115
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Pt.2	*See* ZfI-Mitt-98	DE86700471	MN -4	11:11714
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Report Number	Availability Source	File Number		Distribution Category	Abstract Number
20	*See* LAL-RT-84-05		DE86750372	MN -28	11:11811
21	*See* LAL-RT-84-04		DE86750377	MN -28	11:11810
CONF-8409219-	(2. international workshop on atomic physics for ion fusion, Chilton, UK, 11-14 Sep 1984)				
2	*See* CEA-CONF-7821		DE86750376	MN -21	11:12475
CONF-8409250-	(International symposium on heavy ion fusion reactions, Tsukuba, Japan, 3-5 Sep 1984)				
3	*See* CRN-PN-84-37		DE86750046	MN -34C	11:12312
CONF-8409254-	(3. Joliot-Curie School on nuclear physics: mesons, baryons, quarks, Bombannes, France, 16-21 Sep 1984)				
2	*See* CEA-CONF-7822		DE86750373	MN -34D	11:12358
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CONF-8409287-	(28. irradiation devices working group meeting, Brasimone, Italy, 12-13 Sep 1984)				
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CONF-841007-	(Nuclear science symposium, Orlando, FL, USA, 31 Oct-2 Nov 1984)				
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22	*See* CEA-CONF-7709		DE86750365	MN -37	11:12426
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7	*See* CEA-CONF-7793		DE86750375	MN -34C	11:12357
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1	*See* CNRS-CPT-84-P-1709		DE86750335	MN -34D	11:12400
2	*See* CNRS-CPT-84-P-1705		DE86750391	MN -34B	11:12055
CONF-8410349-	(International colloquium on SAID-SPWLA logs, Paris, France, 23-26 Oct 1984)				
1	*See* CEA-CONF-7879		DE86750371	MN -34C	11:11849
CONF-8410367-	(42. international meeting on agricultural technology, Neu-Ulm, F.R. Germany, 25-26 Oct 1984)				
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	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 116-119(15 May 1985)				11:12107
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 120-123(15 May 1985)				11:12108
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 138-141(15 May 1985)				11:12109

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 181-185(15 May 1985)			11:12110
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 186-189(15 May 1985)			11:12111
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 313-317(15 May 1985)			11:12112
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 156-160(15 May 1985)			11:12113
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 190-194(15 May 1985)			11:12114
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 195-197(15 May 1985)			11:12115
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 32-35(15 May 1985)			11:12116
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 36-38(15 May 1985)			11:12117
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 225-227(15 May 1985)			11:12118
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 356-360(15 May 1985)			11:12289
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 405-410(15 May 1985)			11:12290
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 411-414(15 May 1985)			11:12291
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 436-440(15 May 1985)			11:12308
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 467-472(15 May 1985)			11:12470
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 487-491(15 May 1985)			11:12471
	Nucl. Instrum. Methods Phys. Res., Sect. B, 10/11: 478-482(15 May 1985)			11:12511
CONF-841157-	(Materials Research Society annual meeting, Boston, MA, USA, 26-29 Nov 1984)			
101	*See* RHO-BW-SA-381-P	E 1.99:	DE86004520 MN -70	11:11030
CONF-841194-	(Southeast industrial biomass energy exposition, Atlanta, GA, USA, 28-29 Nov 1984)			
2	*See* PNL-SA-13062	E 1.99:	DE86004869 MN -61D	11:11144
CONF-8411160-	(Workshop on the source term for radionuclide migration from HLW or spent nuclear fuel, Albuquerque, NM, USA, 13-15 Nov 1984)			
	See SAND-85-0380	E 1.99:	DE85016832 MN -70	11:11061
CONF-8411189-	(Symposium on liquid-liquid extraction science, Dounreay, UK, 27-29 Nov 1984)			
1	*See* CEA-CONF-7833		DE86750322 MN -86	11:10987
2	*See* CEA-CONF-7772		DE86750387 MN -10	11:10984
3	*See* CEA-CONF-7686		DE86750388 MN -10	11:10983
CONF-8411210-	(13. congress of the Association for Radiation Protection Science and Technology, Strasbourg, France, 6-8 Nov 1984)			
1	*See* CEA-CONF-7684		DE86750385 MN -83	11:11080
CONF-8411225-	(Seminar on prevention of condenser failures-the state of the art, Palo Alto, CA, USA, 13-15 Nov 1984)			
	See EPRI-CS-4329-SR		TI86920099 ND -97	11:11215
CONF-8411226-	(Jubilee meeting of Deutscher Kaelte- und Klimatechnischer Verein e.V., Baden-Baden, F.R. Germany, 21-23 Nov 1984)			
Trans.	NTIS (US Sales Only), PC A99/MF A01; 1		DE86770071 MN -95	11:11422
CONF-841202-	(Symposium on thermal insulation, materials and systems, Dallas, TX, USA, 2-6 Dec 1984)			
4	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004810 MN -41	11:11865
CONF-841210-	(International chemical congress of Pacific Basin Society, Honolulu, HI, USA, 16-21 Dec 1984)			
27	*See* CEA-CONF-7705		DE86750383 MN -83	11:11605
28	*See* CEA-CONF-7704		DE86750384 MN -83	11:11604
29	*See* CEA-CONF-7706		DE86750386 MN -4	11:11606
CONF-841218-	(31. national vacuum symposium, Reno, NV, USA, 3-7 Dec 1984)			
29	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004806 MN -34A	11:11506
CONF-841246-	(1. international conference on fusion reactor materials, Tokyo, Japan, 3-6 Dec 1984)			
27	*See* CEA-CONF-7691		DE86750354 MN -20d	11:12474
30	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004808 MN -20c	11:11507
CONF-841281-	(SFEN meeting on decommissioning of facilities: balance and prospects, Paris, France, 6 Dec 1984)			
3	*See* FRNC-CONF-218		DE86750331 MN -78	11:11242
CONF-841293-	(International symposium on biomolecular structure and interactions, Bangalore, India, 17-22 Dec 1984)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004807 MN -48	11:11946
CONF-850140-	(LEP experimenters' workshop on shower simulation, Geneva, Switzerland, 29-31 Jan 1985)			
2-Rev.	*See* ORNL/TM-9727	E 1.99:	DE86001366 MN -34C	11:12373

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
CONF-850141-	(13. international workshop on gross properties of nuclei and nuclear excitations, Hirschegg, Austria, 14-19 Jan 1985)				
6	*See* DOE/ER/40048-25-N5	E 1.99:	DE86004298	MN -34C	11:12361
CONF-850152-	(3. LEAR workshop, Tignes-Savoie, France, 19-26 Jan 1985)				
15	*See* CEA-CONF-7823		DE86750369	MN -34D	11:12142
CONF-850162-	(Double charge exchange workshop, Los Alamos, NM, USA, 10-12 Jan 1985)				
	See LA-10550-C	E 1.99:	DE86004174	STD -34C	11:12281
CONF-850173-	(23. international winter meeting on nuclear physics, Bormio, Italy, 21-26 Jan 1985)				
7	*See* CEA-CONF-7805		DE86750358	MN -34C	11:12348
CONF-8502101-	(8. biennial session on nuclear physics, Aussois, France, 4-8 Feb 1985)				
3	*See* CEA-CONF-7796		DE86750355	MN -34C	11:12316
4	*See* CEA-CONF-7801		DE86750356	MN -34C	11:12285
5	*See* CEA-CONF-7800		DE86750357	MN -34C	11:12294
6	*See* CEA-CONF-7794		DE86750368	MN -34C	11:12284
7	*See* CEA-CONF-7795		DE86750379	MN -34C	11:12342
CONF-850386-	(Passive and hybrid solar low energy building design - Swiss IEA results, Zurich, Switzerland, 28 Mar 1985)				
Pt.1	NTIS (US Sales Only), PC A06/MF A01; 1		DE86770067	MN -59B	11:11185
CONF-850414-	(General meeting of the American Physical Society, Washington, DC, USA, 25-27 Apr 1985)				
	AIP Conf. Proc., No. 135, 448-471(1985)				11:11198
	AIP Conf. Proc., No. 135, 472-496(1985)				11:11209
	AIP Conf. Proc., No. 135, 52-80(1985)				11:11375
	American Institute of Physics, 335 East 45th St., New York, NY 10017, $55.00				11:11450
	AIP Conf. Proc., No. 135, 92-121(1985)				11:11451
	AIP Conf. Proc., No. 135, 148-168(1985)				11:11452
	AIP Conf. Proc., No. 135, 247-257(1985)				11:11453
	AIP Conf. Proc., No. 135, 258-269(1985)				11:11454
	AIP Conf. Proc., No. 135, 299-322(1985)				11:11455
	AIP Conf. Proc., No. 135, 323-346(1985)				11:11456
	AIP Conf. Proc., No. 135, 299-246(1985)				11:11873
CONF-8504110-	(Joint Los Alamos/CEA meeting on Monte Carlo methods, Cadarache, France, 22-26 Apr 1985)				
20	*See* CEA-CONF-7902		DE86750106	MN -34C	11:12382
CONF-850521-	(Anaerobic biogeochemical processes in subsurface transport - an interactive seminar, University Park, PA, USA, 14-16 May 1985)				
2	*See* DOE/ER-0252	E 1.99:	DE86004279	MN -11	11:11894
CONF-850535-	(European symposium on few-body physics - mesons and light nuclei III, Bechyne Castle, Czechoslovakia, 27 May-1 Jun 1985)				
3	*See* TRI-PP-85-28		DE86900324	MN -34C	11:12288
CONF-8505112-	(2. international symposium on the biology and toxicology of metals using nuclear analytical methods, Upton, NY, USA, 20-22 May 1985)				
4	*See* BNL-37327	E 1.99:	DE86005265	MN -48	11:11965
CONF-8505223-	(Coupling of ecological studies workshop, Athens, GA, USA, 15-18 May 1985)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004794	MN -11	11:11893
CONF-850610-	(Annual meeting of the American Nuclear Society, Boston, MA, USA, 9-14 Jun 1985)				
35	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85016413	MN -80	11:11287
CONF-850672-	(2. international conference on nucleus-nucleus collisions, Visby, Sweden, 10-14 Jun 1985)				
9	*See* TRI-PP-85-64		DE86900368	MN -34C	11:12374
CONF-8506197-	(Workshop on elastic and diffractive scattering at the collider, Chateau de Blois, France, 3-6 Jun 1985)				
4	*See* CERN-EP-85-159		DE86900390	MN -34D	11:12182
CONF-850784-	(Computer analysis for life science, Okayama, Japan, 9-12 Jul 1985)				
3	*See* LA-UR-85-4307	E 1.99:	DE86004736	MN -48	11:12088
CONF-850785-	(5. international conference on physics in collision, Autun, France, 3-5 Jul 1985)				
6	*See* CERN-EP-85-192	E 1.99:	DE86004531	MN -34D	11:12144
7	*See* CERN-EP-85-168		DE86900399	MN -34C	11:12295
CONF-850799-	(4. IEA task workshop on electrolytic hydrogen production, Julich, F.R. Germany, 14-17 Jul 1985)				
1	*See* BNL-36756	E 1.99:	DE86002503	MN -94d	11:11119
CONF-8507103-	(Fluidized Bed Combustion (FBC) materials workshop, Nova Scotia, Canada, 29 Jul-1 Aug 1985)				
1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004046	MN -90e	11:10896
CONF-850814-	(Cryogenic engineering conference and international cryogenic materials conference, Boston, MA, USA, 12-16 Aug 1985)				
33	*See* LBL-19395	E 1.99:	DE86002897	MN -28	11:11805

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
CONF-850069-	(Meeting of the Particles and Fields Division of the American Physical Society, Eugene, OR, USA, 12-15 Aug 1985)			
11	*See* DOE/ER/03072-28	E 1.99: DE86004410	MN -34C	11:12154
12	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004962	MN -34D	11:12223
13	*See* BNL-37294	E 1.99: DE86005051	MN -34D	11:12141
14	*See* BNL-37234	E 1.99: DE86005052	MN -34D	11:12140
CONF-850670-	(5. international conference on solid-state ionics, Lake Tahoe, CA, USA, 18-24 Aug 1985)			
5	*See* BNL-37301	E 1.99: DE86005056	MN -25	11:11573
CONF-850671-	(International conference on neutron scattering, Santa Fe, NM, USA, 19-24 Aug 1985)			
22	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004202	MN -34C	11:11508
CONF-8508105-	(DOE subcritical reactivity measurements workshop, Albuquerque, NM, USA, 26-29 Aug 1985)			
6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86001357	MN -46	11:11268
7	*See* LA-UR-85-4176	E 1.99: DE86004725	MN -46	11:11284
CONF-8508120-	(Kyoto international symposium: the jubilee of the meson theory, Kyoto, Japan, 15-17 Aug 1985)			
3	*See* TRI-PP-85-72	DE86900366	MN -34D	11:12164
CONF-8508127-	(Nuclear chromodynamics conference, Santa Barbara, CA, USA, 12-13 Aug 1985)			
9	*See* ANL-HEP-CP-85-103	E 1.99: DE86003061	MN -34C	11:12356
10	*See* DOE/ER/40048-30-N5	E 1.99: DE86004297	MN -34D	11:12362
11	*See* DOE/ER/40048-33-N5	E 1.99: DE86004287	MN -34C	11:12225
CONF-8508153-	(34. annual Denver conference on applications of x-ray analysis, Snowmass, CO, USA, 5-9 Aug 1985)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004204	MN -34C	11:11557
CONF-850918-	(International topical meeting on high level nuclear waste disposal - technology and engineering, Pasco, WA, USA, 24-26 Sep 1985)			
9	*See* LBL-20166	E 1.99: DE86005213	MN -70	11:11059
CONF-850921-	(5. international conference on hypernuclear and kaon physics, Upton, NY, USA, 9-13 Sep 1985)			
6	*See* BNL-37314	E 1.99: DE86005058	MN -34C	11:11793
7	*See* BNL-37316	E 1.99: DE86005050	MN -34	11:12036
CONF-850925-	(3. international symposium on radiation physics, Ferrara, Italy, 30 Sep-4 Oct 1985)			
2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86005162	MN -34A	11:12066
CONF-850933-	(13. international conference on solid state nuclear track detectors, Rome, Italy, 23-27 Sep 1985)			
3	*See* PNL-SA-13388	E 1.99: DE86004879	MN -41	11:11836
CONF-850942-	(190. American Chemical Society national meeting, Chicago, IL, USA, 8-13 Sep 1985)			
42	*See* BNL-37162	E 1.99: DE86003381	MN -34C	11:12327
45	*See* BNL-37156	E 1.99: DE86003380	MN -28	11:11792
CONF-850944-	(Muskoka conference: international symposium on acidic precipitation, Toronto, Ontario, Canada, 15-20 Sep 1985)			
4	*See* PNL-SA-13028	E 1.99: DE86004862	MN -90i	11:11872
CONF-850956-	(7. international free-electron laser conference, Tahoe City, CA, USA, 8-13 Sep 1985)			
Absts.	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE86003485	MN -38	11:11755
CONF-850995-	(Materials Research Society international symposium, Stockholm, Sweden, 9-12 Sep 1985)			
5	*See* CEA-CONF-7900	DE86750378	MN -70	11:11057
7	*See* PNL-SA-12879	E 1.99: DE86004867	MN -70	11:11060
CONF-8509121-	(7. annual DOE LLWMP participants information meeting, Las Vegas, NV, USA, 10-13 Sep 1985)			
25	*See* EGG-M-23085	DE86004115	MN -70B	11:11013
26	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86005149	MN -70B	11:11058
CONF-8509142-	(Geothermal program review, Washington, DC, USA, 11-12 Sep 1985)			
	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE86004074	STD -66	11:11199
9	*See* LA-UR-85-3733	E 1.99: DE86002445	MN -34C	11:12372
CONF-8509148-	(TRIUMF accelerated radioactive beams workshop, Parksville, BC, Canada, 4-7 Sep 1985)			
4	*See* DOE/ER/40048-03-N6	E 1.99: DE86004304	MN -34C	11:12360
CONF-8509154-	(International battery testing workshop, Heidelberg, F.R. Germany, 29 Sep-2 Oct 1985)			
Summs.	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE86001615	MN -94c	11:11368
CONF-8509162-	(3. European workshop on problems in the numerical modeling of plasmas, Varenna, Italy, 10-13 Sep 1985)			
7	*See* PPPL-2290	E 1.99: DE86005032	STD -20g	11:12453
CONF-8509192-	(Course and workshop on applications of RF waves to tokamak devices, Varenna, Italy, 5-14 Sep 1985)			
5	*See* GA-A-18149	E 1.99: DE86004851	MN -20a	11:12439
CONF-8509193-	(International conference on applications of the Mossbauer effect, Leuven, Belgium, 16-20 Sep 1985)			
2	*See* LBL-19380	E 1.99: DE86005229	MN -25	11:11522
CONF-8509203-	(International conference on dimensions and entropies in chaotic systems, Pecos River, NM, USA, 11-16 Sep 1985)			
2	*See* LA-UR-85-4263	E 1.99: DE86004732	MN -48	11:11978

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
3	*See* LA-UR-85-4265	E 1.99: DE86004733	MN -32	11:12421
4	*See* LA-UR-85-4331	E 1.99: DE86004740	MN -32	11:12521
5	*See* LA-UR-85-4262	E 1.99: DE86004731	MN -32	11:12420
CONF-8509206-	(RCNP-KIKUCHI summer school, Osaka, Japan, 1 Sep 1985)			
1	*See* LA-UR-85-2991	E 1.99: DE85017540	MN -34C	11:12282
CONF-8509207-	(Symposium on recent advances in the study of nuclei off the line of stability, Chicago, IL, USA, 8-18 Sep 1985)			
8	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004785	MN -34C	11:12067
CONF-8509212-	(2. international workshop on lung dosimetry, Cambridge, England, 2-6 Sep 1985)			
2	*See* PNL-SA-13453	E 1.99: DE86004866	MN -41	11:12000
CONF-8509213-	(Frontiers of quantum Monte Carlo conference, Los Alamos, NM, USA, 3-6 Sep 1985)			
2	*See* LA-UR-85-4451	E 1.99: DE86004750	MN -34D	11:12252
CONF-8509216-	(US-Japan workshop on advanced plasma modeling, Nagoya, Japan, 24-27 Sep 1985)			
1	*See* UCRL-93686	E 1.99: DE86004238	MN -20a	11:12456
CONF-8509219-	(Cray users group meeting, Montreal, Canada, 30 Sep-3 Oct 1985)			
1	*See* LA-UR-85-4404	E 1.99: DE86004746	MN -32	11:12522
CONF-851003-	(Conference on coal science, Sydney, Australia, 28 Oct-1 Nov 1985)			
15	*See* PNL-SA-12628	E 1.99: DE86004878	MN -90d	11:10792
CONF-851009-	(IEEE nuclear science symposium, San Francisco, CA, USA, 23-25 Oct 1985)			
34	*See* EGG-M-27785	E 1.99: DE86004153	MN -78	11:11304
41	*See* BNL-37221	E 1.99: DE86004355	MN -32	11:12519
46	*See* LBL-19667	E 1.99: DE86005212	MN -48	11:11979
CONF-851021-	(19. international thermal conductivity conference, Cookeville, TN, USA, 20-23 Oct 1985)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004796	MN -25	11:11280
CONF-851040-	(Symposium of northeastern accelerator personnel, Argonne, IL, USA, 14-17 Oct 1985)			
4	*See* DOE/ER/40124-7	E 1.99: DE86004291	MN -34C	11:11802
CONF-851048-	(168. meeting of the Electrochemical Society, Las Vegas, NV, USA, 13-18 Oct 1985)			
11	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86003074	MN -94a	11:11360
CONF-851050-	(International symposium on whole-plant physiology: coupling of carbon, water, and nutrient interactions in woody plant soil systems, Knoxville, TN, USA, 6-11 Oct 1985)			
Absts.	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE86000320	MN -48	11:11162
CONF-851068-	(10. international symposium on polynuclear aromatic hydrocarbons, Columbus, OH, USA, 21-23 Oct 1985)			
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004778	MN -48	11:12006
CONF-8510103-	(Automotive technology development contractors' coordination meeting, Dearborn, MI, USA, 20-25 Oct 1985)			
1	*See* DOE/NASA-1005-7	E 1.99: DE86003187	STD -96	11:11491
2	*See* DOE/NASA/50112-60	E 1.99: DE86003202	STD -96	11:11492
4	*See* DOE/NASA/51044-37	E 1.99: DE86005099	STD -25	11:11517
CONF-8510118-	(DOE's natural phenomena hazards mitigation conference, Las Vegas, NV, USA, 7-11 Oct 1985)			
	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99: DE86001557	MN -41	11:11769
CONF-8510133-	(Research coordination on performance of solidified HLW forms and engineered barriers under repository conditions, Tokai-mura, Japan, 28 Oct-1 Nov 1985)			
1	*See* PNL-SA-13456	E 1.99: DE86004860	MN -70	11:11029
CONF-8510159-	(2. international conference on acoustic emission, Lake Tahoe, NV, USA, 28 Oct-1 Nov 1985)			
2	*See* PNL-SA-13120	TI86004024	MN -80	11:11270
CONF-8510167-	(Biomass thermal chemical conversion contractors' meeting, Minneapolis, MN, USA, 15-16 Oct 1985)			
4	*See* PNL-SA-13471	E 1.99: DE86004863	MN -61D	11:11132
CONF-8510168-	(TMS/AIME fall meeting, Toronto, Canada, 13-17 Oct 1985)			
5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86004790	MN -25	11:11509
6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86005020	MN -25	11:11510
CONF-8510172-	(3. international conference and workshop on radiative properties of hot dense matter, Williamsburg, VA, USA, 14-18 Oct 1985)			
3	*See* LA-UR-85-4335	E 1.99: DE86004742	MN -34A	11:12384
CONF-8510173-	(13. water reactor safety research information meeting, Gaithersburg, MD, USA, 22-25 Oct 1985)			
33	*See* BNL-NUREG-37186	TI86003376	MN -78	11:11225
35	*See* PNL-SA-13423	TI86002819	MN -78	11:11526
36	NTIS, PC A02/MF A01 - GPO	TI86003804	MN -78	11:11301
37	*See* PNL-SA-13419	TI86004025	MN -78	11:11256
40	NTIS, PC A03/MF A01 - GPO	TI86004032	MN -78	11:11231
43	*See* BNL-NUREG-37324	TI86004357	MN -78	11:11298

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
CONF-8510194-	(2. international workshop on accelerator control systems, Los Alamos, NM, USA, 7-10 Oct 1985)			
10	*See* BNL-37310	E 1.99: DE86005055	MN -28	11:11783
CONF-8510195-	(Assessment of myocardial metabolism by cardiac imaging symposium, Vienna, Austria, 26 Oct 1985)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86005161	MN -48	11:11972
CONF-8510209-	(U.S.-Japan next step machine design workshop at JAERI, Mito, Japan, 21-25 Oct 1985)			
3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86004783	MN -20	11:12482
CONF-8510218-	(Field data acquisition for building and equipment energy-use monitoring national workshop, Dallas, TX, USA, 16 Oct 1985)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86005026	MN -95d	11:11442
CONF-8510220-	(Murr slow positron beam workshop, Columbia, MO, USA, 1-4 Oct 1985)			
2	*See* BNL-37296	E 1.99: DE86005057	MN -34A	11:11114
CONF-8510225-	(Hanford life sciences symposium, Richland, WA, USA, 21-24 Oct 1985)			
2	*See* PNL-SA-13266	E 1.99: DE86004403	MN -90i	11:10927
3	*See* PNL-SA-12608	E 1.99: DE86004864	MN -48	11:12025
4	*See* PNL-SA-13233	E 1.99: DE86004868	MN -4	11:11620
5	*See* PNL-SA-13284	E 1.99: DE86004877	MN -90d	11:10928
CONF-8510245-	(International conference on solid state ionics, Lake Tahoe, CA, USA, 18-24 Oct 1985)			
1	NTIS, PC A02; 3	DE86004200	MN -25	11:11577
CONF-8510248-	(2. United States/Japan exchange workshop on "superconducting magnet requirements for long-pulse tokamaks", Tokai, Japan, 29 Oct-1 Nov 1985)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86003092	MN -20b	11:12483
CONF-8510250-	(Department of Energy (DOE) meterology workshop, Lake Placid, NY, USA, 1-4 Oct 1985)			
1	*See* DP-MS-85-116	E 1.99: DE86004624	MN -11	11:11866
CONF-851102-	(11. symposium on engineering problems in fusion research, Austin, TX, USA, 18-22 Nov 1985)			
50	*See* UCRL-92557	E 1.99: DE86004236	MN -21	11:12507
52	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004765	MN -20	11:12428
53	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004767	MN -20b	11:12477
55	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004779	MN -20	11:12429
56	*See* LA-UR-85-3988	E 1.99: DE86004718	MN -20g	11:12495
57	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004805	MN -20	11:12478
58	NTIS, PC A02; 3	DE86004793	MN -20a	11:12479
59	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004758	MN -20	11:12480
60	NTIS, PC A02; 3	DE86005028	MN -20	11:12481
61	*See* UCRL-92514	E 1.99: DE86005082	MN -20	11:12455
75	*See* LBL-19540	E 1.99: DE86005221	MN -20	11:11788
CONF-851113-	(Radiopharmaceutical dosimetry symposium, Oak Ridge, TN, USA, 5-8 Nov 1985)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004761	MN -41	11:12389
CONF-851115-	(American Nuclear Society winter meeting, San Francisco, CA, USA, 10-15 Nov 1985)			
42	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004065	MN -79p	11:11299
43	*See* HEDL-SA-3348-FP	E 1.99: DE86004015	MN -79b	11:11315
CONF-851125-	(American Society of Mechanical Engineers winter annual meeting, Miami, FL, USA, 17-21 Nov 1985)			
17	*See* PNL-SA-13318	TI86004022	MN -78	11:11342
CONF-851136-	(Meeting of the Plasma Physics Division of the American Physical Society, San Diego, CA, USA, 4-8 Nov 1985)			
4	*See* DOE/DP/40200-18	E 1.99: DE86004826	MN -21	11:12490
CONF-851146-	(Annual battery and electrochemical energy storage contractors' meeting, Washington, DC, USA, 18-21 Nov 1985)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004057	MN -94cb	11:11363
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004058	MN -94cb	11:11364
Summs.	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99: DE86003020	STD -94c	11:11365
CONF-851174-	(32. national vacuum symposium and topical conference, Houston, TX, USA, 19-22 Nov 1985)			
24	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004682	MN -83	11:11763
25	*See* SAND-85-1364C	E 1.99: DE86004607	MN -20	11:12501
26	*See* PNL-SA-13275	E 1.99: DE86004857	MN -25	11:11621
CONF-851185-	(International laser science conference, Dallas, TX, USA, 18-22 Nov 1985)			
2	*See* UCRL-93471	E 1.99: DE86003492	MN -34A	11:12092
CONF-851192-	(International workshop on high temperature molten salt batteries, Argonne, IL, USA, 5-7 Nov 1985)			
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2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004036	MN -94c	11:11367
CONF-8511120-	(AIAA laser effects and target response meeting, Menlo Park, CA, USA, 5-7 Nov 1985)			
3	*See* LA-UR-85-4472	E 1.99: DE86004752	MN -21	11:12496
CONF-8511121-	(Department of Energy (DOE) uranium workshop, Rockville, MD, USA, 5-7 Nov 1985)			
2	*See* PNL-SA-13561	E 1.99: DE86004872	MN -41	11:12001

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CONF-8511131-	(5. international workshop electron cyclotron emission and electron, San Diego, CA, USA, 9-12 Nov 1985)				
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3	*See* GA-A-18241	E 1.99:	DE86004854	MN -20a	11:12440
CONF-8511136-	(Direct liquefaction contractors conference, Pittsburgh, PA, USA, 19-21 Nov 1985)				
3	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004799	MN -90a	11:10919
CONF-8511137-	(Workshop on the investigation of fundamental interactions with cold neutrons, Gaithersburg, MD, USA, 14-15 Nov 1985)				
2	*See* LA-UR-85-4009	E 1.99:	DE86003670	MN -34	11:12162
CONF-8511140-	(Chemical defense conference, Aberdeen Proving Ground, MD, USA, 19-23 Nov 1985)				
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CONF-851201-	(7. Miami international conference on alternative energy sources, Miami Beach, FL, USA, 9-11 Dec 1985)				
5	*See* PNL-SA-13507	E 1.99:	DE86004870	MN -62	11:11177
6	*See* PNL-SA-13157	E 1.99:	DE86004875	MN -90	11:10793
7	*See* LA-UR-85-4332	E 1.99:	DE86004741	MN -66a	11:11201
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CONF-851202-	(DOE-ORNL-ASHRAE-BTECC conference on thermal performance of the exterior envelopes of buildings-III, Clearwater Beach, FL, USA, 2-5 Dec 1985)				
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5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005163	MN -95d	11:11420
CONF-851217-	(Materials Research Society meeting, Boston, MA, USA, 2-7 Dec 1985)				
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17	*See* DP-MS-85-117		DE86004893	MN -70	11:11010
18	*See* SAND-85-1208C	E 1.99:	DE86004621	MN -25	11:11527
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23	*See* SAND-85-2606C	E 1.99:	DE86004987	MN -25	11:11587
CONF-851235-	(American Geophysical Union fall meeting, San Francisco, CA, USA, 9-13 Dec 1985)				
1	*See* DP-MS-85-105	E 1.99:	DE86004614	MN -11	11:11864
CONF-851251-	(7. international conference on computing methods in applied sciences and engineering, Versailles, France, 9-13 Dec 1985)				
1	*See* UCRL-93699	E 1.99:	DE86004239	MN -20f	11:12457
CONF-851252-	(Geographic information systems in the government workshop, Springfield, VA, USA, 10-13 Dec 1985)				
1	*See* UCRL-93415	E 1.99:	DE86004919	MN -11	11:11886
CONF-860204-	(Thermal reactor safety meeting, San Diego, CA, USA, 2-6 Feb 1986)				
1	*See* BNL-NUREG-36987		TI86000632	MN -78	11:11293
2	*See* BNL-NUREG-37004		TI86001200	MN -78	11:11296
4	*See* BNL-NUREG-36989		TI86001189	MN -78	11:11295
5	*See* BNL-NUREG-36985		TI86001170	MN -78	11:11291
6	*See* BNL-NUREG-36986		TI86001190	MN -78	11:11292
7	*See* BNL-NUREG-37005		TI86001199	MN -78	11:11297
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14	*See* SAND-85-1577C		TI86004276	MN -80	11:11349
15	*See* SAND-85-1666C		TI86004275	MN -78	11:11352
CONF-860205-	(8. symposium on geotechnical and geohydrological aspects of waste management, Ft. Collins, CO, USA, 5-7 Feb 1986)				
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CONF-860224-	(4. international modal analysis conference, Los Angeles, CA, USA, 3-6 Feb 1986)				
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DOE/ER/45193-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004951	MN -4	11:11673
DOE/ER/51089-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86002494	STD -21	11:12431
DOE/ER/52068-T10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004834	MN -20	11:11514
T11	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004838	MN -20	11:11515
DOE/ER/52082-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004285	MN -20c	11:12491
DOE/ER/60005-T2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004408	MN -41	11:11881
DOE/ER/60040-02	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004474	MN -48	11:11973
DOE/ER/60068-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004296	MN -48	11:11947
DOE/ER/60149-1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004999	MN -11	11:11857
DOE/ER/60154-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004502	MN -48	11:12007

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
DOE/ER/60186-6	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE86005115	MN -41	11:11882
DOE/ER/60304-1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86004631	MN -11	11:11858
DOE/ER/60351-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86004964	MN -11	11:11905
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86004391	MN -11	11:11859
DOE/ER/60354-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004675	MN -11	11:11906
DOE/ER/80010-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004484	MN -37	11:11848
DOE/ET/10069-T119	NTIS (US Sales Only), PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE86005092	MN -90d	11:10920
DOE/ET/11304-35	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86004849	MN -93A	11:11407
DOE/ET/17086-1932	NTIS, PC A22/MF A01; 1 (GPO Dep.)	E 1.99: DE86000823	STD -90	11:10735
DOE/ET/25102-T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE86003484	STD -94cb	11:11369
DOE/ET/34215-37	NTIS (US Sales Only), PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86004189	STD -78	11:11232
DOE/ET/51013-T7	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004401	MN -20	11:12492
DOE/ET/52048-32	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004527	MN -20	11:12493
DOE/ET/53088-198	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004561	MN -20g	11:12432
202	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86005399	MN -20g	11:12433
212	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86004562	MN -20g	11:12434
214	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86005400	MN -20g	11:12435
216	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86004563	MN -20g	11:12436
218	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86004564	MN -20g	11:12437
219	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86005401	MN -20g	11:12438
223	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86005403	MN -20g	11:12494
DOE/EV/00890-9	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86004921	MN -11	11:11907
DOE/EV/00901-T5	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86005139	MN -11	11:12034
DOE/EV/01340-14	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE86004995	MN -11	11:11908
15	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86004994	MN -11	11:11860
17	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004819	MN -11	11:11861
T4	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE86004992	MN -11	11:11862
T5	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86004993	MN -11	11:11863
DOE/FE-0052	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE86005391	MN -92	11:10955
DOE/FE/60177-1953	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004933	STD -91	11:10967
DOE/FE/60181-176	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86003912	MN -90	11:10797
DOE/FE/60334-T1	NTIS MF A01; 2 (GPO Dep.)	E 1.99: DE86004524	MN -90	11:11140
DOE/ID/12129-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86005065	STD -97e	11:11152
DOE/ID/12509-1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86005498	MN -70B	11:11000
DOE/ID/12532-1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86005350	MN -95e	11:11477
DOE/IG-0223	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86005152	STD -13	11:12515
DOE/IR/10425-T2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86002047	MN -13	11:11385
DOE/LLW-18T-Rev.6	NTIS, PC A20/MF A01 (GPO Dep.)	E 1.99: DE86004602	STD -70B	11:11001
31T	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE86005107	STD -70B	11:11002
DOE/MA-0142/ 2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86005104	MN -13	11:12512
0196	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86005145	MN -13	11:11444
DOE/MC/14593-1981	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86001047	STD -90c	11:10741
DOE/MC/16433-1977	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE86001045	MN -90c	11:10742
DOE/MC/19352-1763	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99: DE86001015	STD -90i	11:10803
DOE/MC/20122-2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85012880	MN -90b	11:10854
4	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86004815	MN -90b	11:10855
DOE/MC/21088-1964	NTIS, PC A07/MF A01; 1	DE86001011	STD -92a	11:10958
DOE/MC/21119-T4	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE86004633	MN -92	11:10965

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
DOE/MC/49941-1833	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86004295	STD -93A	11:11408
DOE/METC-86/ 6030	NTIS, PC A10/MF A01 (GPO Dep.)	E 1.99: DE86001021	MN -90c	11:10778
DOE/NASA-0312-1	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99: DE86005045	STD -96	11:11490
0340-1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE86005012	STD -96	11:11487
0363-1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86005013	STD -25	11:11516
1005-7	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86003187	STD -96	11:11491
DOE/NASA/0255-1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE86004560	STD -97d	11:11409
DOE/NASA/50112-60	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86003202	STD -96	11:11492
DOE/NASA/51044-37	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86005099	STD -25	11:11517
DOE/NBM-6004983	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE86004983	MN -95d	11:11482
6005390	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86005390	MN -70	11:11081
DOE/NE-0025/ 4	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86004535	STD -70A	11:11003
DOE/NV/10250-23	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86005033	MN -70	11:10989
DOE/OR/00033-T166	NTIS, PC A21/MF A01; 1 (GPO Dep.)	E 1.99: DE86003025	MN -98	11:11393
DOE/OR/20917-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86004529	MN -13	11:12513
DOE/OR/21400-T213	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004213	MN -94	11:11770
T216	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86005147	MN -90	11:10779
DOE/OR/21558-1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE86004518	STD -70	11:11004
DOE/PC/30248-T2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86003909	MN -90i	11:11966
DOE/PC/50801-12	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004271	MN -90a	11:10798
DOE/PC/60046-7	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86003932	MN -90d	11:10780
DOE/PC/60798-9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004550	MN -90a	11:10781
DOE/PC/60801-8	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004349	MN -90e	11:10905
DOE/PC/60802-T4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86004513	MN -90i	11:10906
T5	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86004515	MN -90i	11:11734
T6	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86004514	MN -90i	11:10907
DOE/PC/60804-T9	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004544	MN -90d	11:11674
DOE/PC/60813-9	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86003827	MN -90d	11:10782
DOE/PC/62999-8	NTIS, PC A05; 3	DE86004358	MN -90a	11:10921
DOE/PC/70018-13	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE86005271	MN -90d	11:10783
DOE/PC/70764-3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86003908	MN -90a	11:10908
4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86003944	MN -90a	11:10909
DOE/PC/70768-3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86003871	MN -90d	11:10784
DOE/PC/70776-T3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004272	MN -90a	11:10856
DOE/PC/70780-T3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004479	MN -90a	11:11141
DOE/PC/70788-T3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86002829	MN -90d	11:11130
DOE/PC/70800-T3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004263	MN -90d	11:11131
DOE/PC/70809-T4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004559	MN -90	11:10799
DOE/PC/70812-5	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86004551	MN -90d	11:10785
DOE/PC/70814-5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004387	MN -90d	11:10786
DOE/PC/71257-T4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86003878	MN -90d	11:11142
DOE/PC/80512-T3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004262	MN -90i	11:10804
DOE/PC/80752-T2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86003942	MN -90e	11:10910
DOE/PC/80913-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86005168	MN -90a	11:10787
DOE/PC/81003-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86005129	MN -90i	11:10788
DOE/PC/81205-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004157	MN -90b	11:10857

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
DOE/PC/81504-					
T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004273	MN -90a	11:10858
DOE/PE/77000-					
1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86000564	STD -96	11:11461
DOE/PETC/QTR-					
85/ 3	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004954	STD -90	11:10911
DOE/PETC/TR-					
86/ 2	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99:	DE86004896	STD -90b	11:10859
86/ 3	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005397	STD -90	11:10912
DOE/R1/10004-					
T1	NTIS, PC A03; 3		DE86000353	MN -95d	11:11445
DOE/R9/50021-					
T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86000350	MN -97e	11:11151
DOE/RA/12117-					
5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005290	STD -97e	11:11153
DOE/RA/50219-					
T7	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005067	MN -41	11:12016
DOE/RL/01830-					
T40	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004215	MN -96	11:11494
DOE/RW-					
0006-Rev.1	NTIS, PC A14/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005264	STD -70	11:11005
0038-Draft	NTIS, PC A06; 3 (GPO Dep.)	E 1.99:	DE86004487	MN -70	11:11006
0040	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005395	MN -70	11:11007
0043	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE86005396	MN -70	11:11008
0045	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005522	MN -70	11:10990
DOE/SF/00893-					
T24	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85018251	MN -79	11:11265
DOE/WIPP-					
221	NTIS, PC A99/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004904	MN -70	11:11009
DP-					
1708	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005343	STD -11	11:11922
1713	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005337	STD -4	11:11611
DP-MS-					
85-105	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004614	MN -11	11:11864
85-116	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004624	MN -11	11:11866
85-117	NTIS, PC A02; 3		DE86004893	MN -70	11:11010
DPh-N-					
2242bis	*See* CEA-CONF-7800		DE86750357	MN -34C	11:12294
DPh-N-S-					
2194	*See* CEA-CONF-7509		DE86750362	MN -34C	11:12328
2223	*See* CEA-CONF-7793		DE86750375	MN -34C	11:12357
2226	*See* CEA-CONF-7796		DE86750355	MN -34C	11:12316
2227	*See* CEA-CONF-7795		DE86750379	MN -34C	11:12342
2230	*See* CEA-CONF-7794		DE86750368	MN -34C	11:12284
2232	*See* CEA-CONF-7805		DE86750358	MN -34C	11:12348
2237	*See* CEA-CONF-7822		DE86750373	MN -34D	11:12358
2242ter	*See* CEA-CONF-7801		DE86750356	MN -34C	11:12285
2251	*See* CEA-CONF-7823		DE86750369	MN -34D	11:12142
EGG-					
2422	*See* NUREG/CR-4428		TI86004708	MN -78	11:11337
2427	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005010	STD -70	11:11011
2429	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE86005011	STD -70	11:11012
10282-1081	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004890	STD -41	11:11900
10282-2082	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005098	MN -48	11:10937
EGG-EA-					
6422-Rev.1	NTIS, PC A05/MF A01 - GPO		TI86005351	MN -78	11:11239
6973	NTIS, PC A02/MF A01 - GPO		TI86005353	MN -78	11:11261
7116	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005282	MN -80	11:11283
EGG/LTR-					
17-50	NTIS, PC A02; 3		DE85015851	MN -78	11:11240
EGG-M-					
18485	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004120	MN -80	11:11302
23085	NTIS, PC A02 - GPO		DE86004115	MN -70B	11:11013
24585	NTIS, PC A02/MF A01 - GPO		TI86003231	MN -80	11:11303
27785	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004153	MN -78	11:11304
EGG-NTA-					
7065	NTIS, PC A03/MF A01 - GPO		TI86003256	MN -78	11:11305
7088	NTIS, PC A02/MF A01 - GPO		TI86004122	MN -78	11:11306
7094	NTIS, PC A02/MF A01 - GPO		TI86004131	MN -78	11:11307
7097	NTIS, PC A02/MF A01 - GPO		TI86004130	MN -78	11:11308
7099	NTIS, PC A02/MF A01 - GPO		TI86004121	MN -78	11:11309
7112	NTIS, PC A02/MF A01 - GPO		TI86005352	MN -78	11:11262
EGG-PBS-					
6798	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004110	MN -78	11:11241
7013	NTIS, PC A02/MF A01 - GPO		TI86005326	MN -70B	11:11014
7027	NTIS, PC A02/MF A01 - GPO		TI86005328	MN -70B	11:11015
EGG-PHY-					
7086	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005317	MN -34C	11:12329
EGG-RE-D-					
77-194	*See* EGG/LTR-17-50		DE85015851	MN -78	11:11240
EGG-REQ-					
7074	NTIS, PC A06/MF A01 - GPO		TI86004147	MN -78	11:11233
EGG-RTH-					
7064	NTIS, PC A03/MF A01 - GPO		TI86004143	MN -78	11:11310

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
7066	NTIS, PC A05/MF A01 - GPO	TI86003255	MN -78	11:11311
EPA/520/1-				
83-002	*See* PB-85-239275/XAB			11:11884
EPA/520/5-				
6-83/ 006	*See* PB-85-242295/XAB			11:11885
83/ 005	*See* PB-85-239267/XAB			11:11883
EPA/600-				
D-85/ 149	*See* PB-85-236719/XAB			11:11915
D-85/ 158	*See* PB-85-237857/XAB			11:11871
D-85/ 161	*See* PB-85-236099/XAB			11:11870
D-85/ 174	*See* PB-85-243467/XAB			11:12024
EPRI-AP-				
4378	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920121	ND -90d	11:10789
EPRI-CS-				
4329-SR	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920099	ND -97	11:11215
4382	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920124	ND -90e	11:11222
4383	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303	TI86920125	ND -90b	11:10860
EPRI-EA-				
4031	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI85920825	ND -97c	11:11399
4318-Vol.1	NTIS, PC A07/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99: DE86005358	MN -48	11:12017
4318-Vol.2	NTIS, PC A03/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99: DE86005359	MN -48	11:12018
4318-Vol.3	NTIS, PC A05/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99: DE86005360	MN -48	11:12019
4318-Vol.4	NTIS, PC A04/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99: DE86005361	MN -48	11:12020
4318-Vol.5	NTIS, PC A07/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99: DE86005362	MN -48	11:12021
4318-Vol.6	NTIS, PC A04/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99: DE86005363	MN -48	11:12022
4318-Vol.7	NTIS, PC A06/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99: DE86005364	MN -48	11:12023
4355	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920081	ND -98E	11:11400
EPRI-EL-				
4152-Vol.3	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920110	ND -95f	11:11478
4376	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920113	ND -97	11:11771
4381-Vol.1	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920111	ND -97a	11:11772
4381-Vol.2	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920112	ND -97a	11:11773
EPRI-EM-				
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4341	NTIS, PC A05/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99: DE86004395	MN -94cb	11:11370
4389	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303	TI86920115	ND -98E	11:11401
EPRI-NP-				
4307	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920095	ND -78	11:11312
4317	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920096	ND -80	11:11313
4346	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920098	ND -80	11:11226
4350	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920093	ND -80	11:11314
ERCB-				
ST-85-29	Energy Resources Conservation Board, Calgary, Alberta, Canada			11:10917
ERP/CRL-				
84-23	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			11:10800
84-37	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			11:10814
84-044	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			11:10817
85-4	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			11:10818
85-12	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			11:10819
85-18	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			11:10820
ERP/ERL-				
84-31	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			11:10913

Report Number	*Availability Source*	*File Number*		*Distribution Category*	*Abstract Number*
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9220	Commission of the European Communities, Ispra, Italy. Joint Research Center			ND -70	11:11016
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EZ-OPLA-					
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FE-					
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FIAS-R-					
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FNAL-TM-					
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1369	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004699	STD -28	11:11821
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33/ 85	*See* OEFZS-4323		DE86701211	MN -2	11:11230
FRNC-CONF-					
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FRNC-TH-					
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1771	NTIS (US Sales Only), PC A14/MF A01		DE86750326	MN -34B	11:12056
2063	NTIS (US Sales Only), PC A07/MF A01		DE86750380	MN -48	11:11975
2066	NTIS (US Sales Only), PC A07/MF A01		DE86750390	MN -37	11:11822
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17180	GA Technologies, Box 85608, San Diego, CA 92138		TI86900356	MN -77	11:11257
18149	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004851	MN -20a	11:12439
18241	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004854	MN -20a	11:12440
GAO/RCED-					
85-86	US General Accounting Office, Box 6015, Gaitherburg, MD 20760; 3		TI86900181	MN -11	11:11378
GE-					
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GSCan-P-					
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HEDL-SA-					
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HHS/PUB/FDA-					
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HI-					
80-34	*See* DOE/R9/50021-T1	E 1.99:	DE86000350	MN -97e	11:11151
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67729	NTIS, PC A02; 3		DE86005008	MN -11	11:12029
IAEA-CN-					
39/ 95	*See* PNL-SA-8477		TI85016693	MN -78	11:11340
39/ 104	*See* SAND-80-0544C		TI85016663	MN -78	11:11343
44-B-1-5	*See* CEA-CONF-7792		DE86750359	MN -21	11:12427
IAEA-R-					
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IAEA-SM-					
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IAEA-SR-					
87	*See* CEA-CONF-7832		DE86750323	MN -86	11:10986
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85/ 14	NTIS (US Sales Only), PC A02/MF A01		DE86700316	MN -34D	11:12229
85/ 15	NTIS (US Sales Only), PC A02/MF A01		DE86700348	MN -34A	11:12083
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85/ 19	NTIS (US Sales Only), PC A02/MF A01		DE86700317	MN -34D	11:12230
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85/ 22	NTIS (US Sales Only), PC A02/MF A01		DE86700368	MN -34A	11:12129
85/ 23	NTIS (US Sales Only), PC A02/MF A01		DE86700349	MN -34A	11:12084
85/ 25	NTIS (US Sales Only), PC A02/MF A01		DE86700303	MN -34D	11:12402
85/ 28	NTIS (US Sales Only), PC A02/MF A01		DE86700318	MN -34D	11:12231
IDA-P-					
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IEAL-R-					
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IFSR-					
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Report Number	Availability Source	File Number	Distribution Category	Abstract Number
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212	*See* DOE/ET/53088-212	E 1.99: DE86004562	MN -20g	11:12434
214	*See* DOE/ET/53088-214	E 1.99: DE86005400	MN -20g	11:12435
216	*See* DOE/ET/53088-216	E 1.99: DE86004563	MN -20g	11:12436
218	*See* DOE/ET/53088-218	E 1.99: DE86004564	MN -20g	11:12437
219	*See* DOE/ET/53088-219	E 1.99: DE86005401	MN -20g	11:12438
223	*See* DOE/ET/53088-223	E 1.99: DE86005403	MN -20g	11:12494
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16/ 84	NTIS (US Sales Only), PC A03/MF A01	DE86700319	MN -34D	11:12234
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84-99	NTIS (US Sales Only), PC A02/MF A01	DE86700405	MN -34D	11:12190
INDC(CCP)-				
238	NTIS (US Sales Only), PC A03/MF A01	DE86700456	MN -34C	11:12354
INDC(JAP)-				
77/ G	*See* JAERI-M-83-041	DE83902446	MN -34C	11:12279
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159/ LNA	NTIS (US Sales Only), PC A03/MF A01	DE86701210	MN -2	11:12270
165/ GR	NTIS (US Sales Only), PC A02/MF A01	DE86701201	MN -2	11:11924
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Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
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10037	NTIS (US Sales Only), PC A04/MF A01	DE86701206	MN -2	11:12516
10041	NTIS (US Sales Only), PC A16/MF A01	DE86701207	MN -2	11:12272
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84-62	NTIS (US Sales Only), PC A04/MF A01	DE86750392	MN -34D	11:12193
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84-66	NTIS (US Sales Only), PC A02/MF A01	DE86750319	MN -34D	11:12158
84-74	NTIS (US Sales Only), PC A03/MF A01	DE86750367	MN -34D	11:12194
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R-2-85-30	NTIS (US Sales Only), PC A02/MF A01	DE86700399	MN -34D	11:12204
R-2-85-106	NTIS (US Sales Only), PC A02/MF A01	DE86700398	MN -34D	11:12205
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84-3	NTIS (US Sales Only), PC A02/MF A01	DE86700430	MN -34C	11:12371
LA-				
8477-MS	*See* NUREG/CR-1652	TI85015955	MN -78	11:11326

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
10513-PR	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004156	STD -34C	11:12280
10516-MS	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86003283	STD -94cd	11:11410
10550-C	NTIS, PC A19/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004174	STD -34C	11:12281
LA-tr-					
84-22-Rev.	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86003879	MN -32	11:12525
85-36	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005002	MN -22	11:10980
86-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005003	MN -38	11:11767
LA-UR-					
85-2991	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85017540	MN -34C	11:12282
85-3733	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86002445	MN -34C	11:12372
85-3988	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004718	MN -20g	11:12495
85-4009	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86003670	MN -34	11:12162
85-4176	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004725	MN -46	11:11284
85-4262	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004731	MN -32	11:12420
85-4263	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004732	MN -48	11:11978
85-4265	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004733	MN -32	11:12421
85-4307	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004736	MN -48	11:12088
85-4331	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004740	MN -32	11:12521
85-4332	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004741	MN -66a	11:11201
85-4335	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004742	MN -34A	11:12384
85-4404	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004746	MN -32	11:12522
85-4448	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004749	MN -34B	11:12042
85-4451	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004750	MN -34D	11:12252
85-4472	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004752	MN -21	11:12496
LAL-RT-					
84-04	NTIS (US Sales Only), PC A02/MF A01		DE86750377	MN -28	11:11810
84-05	NTIS (US Sales Only), PC A02/MF A01		DE86750372	MN -28	11:11811
84-06	NTIS (US Sales Only), PC A02/MF A01		DE86750370	MN -28	11:11812
84-13	NTIS (US Sales Only), PC A02/MF A01		DE86750374	MN -28	11:11813
LBL-					
19380	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005229	MN -25	11:11522
19395	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86002897	MN -28	11:11805
19540	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005221	MN -20	11:11788
19667	NTIS PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005212	MN -48	11:11979
20025	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE86002967	MN -94c	11:11699
20166	NTIS PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005213	MN -70	11:11059
20560	NTIS, PC A04; 3		DE86005381	MN -48	11:11985
20626	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005225	MN -25	11:11523
20627	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005191	MN -34B	11:11583
LBL-PUB-					
490	NTIS, PC A08/MF A01 (GPO Dep.)	E 1.99:	DE86005122	MN -34	11:12385
LPC-					
84-19	NTIS (US Sales Only), PC A02/MF A01		DE86750314	MN -34D	11:12139
LR-					
505(OP) M	*See* PB-85-237246/XAB				11:10939
LUNFD6/NFFR-					
1007/ 1-121(1985)	NTIS (US Sales Only), PC A03/MF A01		DE86700432	MN -34C	11:11616
3055/ 1-26(1985)	NTIS (US Sales Only), PC A03/MF A01		DE86700445	MN -34C	11:12331
LYCEN-					
8346	NTIS (US Sales Only), PC A05/MF A01		DE86750348	MN -4	11:11617
8437	NTIS (US Sales Only), PC A06/MF A01		DE86750352	MN -34C	11:12287
8462	NTIS (US Sales Only), PC A03/MF A01		DE86750312	MN -34A	11:12089
MAE-					
1640	*See* AD-A-158692/4/XAB				11:11730
MEA-					
2078	*See* NUREG/CR-4422		TI86900460	MN -78	11:11524
MMS/AK/TE-					
84-001	*See* PB-85-237253/XAB				11:10940
MRP/MRL-					
84-89	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario				11:10821
84-90	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario				11:10822
NAK-					
3	NTIS (US Sales Only), PC A03/MF A01		DE86700480	MN -25	11:11024
NASA-CR-					
174907	*See* DOE/NASA-0312-1	E 1.99:	DE86005045	STD -96	11:11490
174971	*See* DOE/NASA-0340-1	E 1.99:	DE86005012	STD -96	11:11487
174988	*See* DOE/NASA/0255-1	E 1.99:	DE86004560	STD -97d	11:11409
175027	*See* DOE/NASA-0363-1	E 1.99:	DE86005013	STD -25	11:11516
NASA-TM-					
87156	*See* DOE/NASA-1005-7	E 1.99:	DE86003187	STD -96	11:11491
87175	*See* DOE/NASA/50112-60	E 1.99:	DE86003202	STD -96	11:11492
87209	*See* DOE/NASA/51044-37	E 1.99:	DE86005099	STD -25	11:11517
NE-F-					
8-6T-Rev.(11-85)	Performance Assurance Project Office-ORNL, Box Y, Oak Ridge, TN 37831		TI86003829	ND -80	11:11274
NEANDC(J)-					
90/ AU	*See* JAERI-M-83-041		DE83902446	MN -34C	11:12279
NIPER-					
B06717-1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004948	MN -92	11:10931
NMRI-					
83-121	*See* AD-A-157984/6/XAB				11:11991
83-122	*See* AD-A-157825/1/XAB				11:11988

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
84-89	*See* AD-A-158066/1/XAB			11:11992
84-91	*See* AD-A-157885/5/XAB			11:11990
85-25	*See* AD-A-157826/9/XAB			11:11989
NOAA-TM-ERL-GLERL-				
56	*See* PB-85-237162/XAB			11:11920
57	*See* PB-85-237154/XAB			11:11919
NP-				
6770068	NTIS (US Sales Only), PC A02/MF A01; 1		DE86770068	MN -13	11:11394
6770069	NTIS (US Sales Only), PC A03/MF A01; 1		DE86770069	MN -13	11:11395
6770070	NTIS (US Sales Only), PC A07/MF A01; 1		DE86770070	MN -90a	11:10801
6900308	North American Electric Reliability Council, Terhune Rd., Princeton, NJ 08540		TI86900308	ND -98E	11:11402
6900327	North American Electric Reliability Council, Terhune Rd., Princeton, NJ 08540		TI86900327	ND -98E	11:11403
NRL-MR-				
5623	*See* AD-A-157930/9/XAB			11:12054
5643	*See* AD-A-158804/5/XAB			11:11782
NUCLEBRAS-CDTN-				
465	NTIS (US Sales Only), PC A06/MF A01		DE86700460	MN -4	11:11618
NUREG-				
0750-Vol.22-Index1	NTIS, PC A04/MF A01 - GPO		TI86900512	MN -2	11:11263
1031-Suppl.4	NTIS, PC A11/MF A01 - GPO		TI86900417	MN -78	11:11324
1079	NTIS, PC A13/MF A01 - GPO		TI86900457	MN -78	11:11325
NUREG/CR-				
1652	NTIS, PC A05/MF A01 - GPO		TI85015955	MN -78	11:11326
1977	NTIS, PC A03/MF A01 - GPO		TI86004938	MN -41	11:11327
2150	NTIS, PC A08/MF A01 - GPO		TI85015978	MN -78	11:11569
2344	NTIS, PC A04/MF A01 - GPO		TI85015991	MN -78	11:11229
2482-Vol.8	NTIS, PC A18/MF A01 - GPO		TI86005240	MN -70	11:11025
3634	NTIS, PC A06/MF A01 - GPO		TI86003557	MN -80	11:11328
4103	NTIS, PC A06/MF A01 - GPO		TI86004006	MN -80	11:11329
4136	NTIS PC E07/MF A01 - GPO		TI86003524	MN -80	11:11740
4171	NTIS PC E06/MF A01 - GPO		TI86005239	MN -78	11:11330
4188-Vol.1	NTIS, PC A08/MF A01 - GPO		TI86004940	MN -80	11:11266
4189	NTIS PC E06/MF A01 - GPO		TI86004715	MN -78	11:11331
4214	NTIS, PC A16/MF A01 - GPO		TI85017968	MN -41	11:11997
4292	NTIS, PC A06/MF A01 - GPO		TI86001821	MN -78	11:11234
4297	NTIS, PC A06/MF A01 - GPO		TI86004937	MN -41	11:11998
4302-Vol.1	NTIS, PC A04/MF A01 - GPO		TI86003618	MN -78	11:11273
4323	NTIS, PC A04/MF A01 - GPO		TI86005079	MN -70	11:11026
4329	NTIS, PC A07/MF A01 - GPO		TI86004934	MN -80	11:11332
4340-1	NTIS, PC A15/MF A01 - GPO		TI86004757	MN -41	11:11333
4344	NTIS, PC A06/MF A01 - GPO		TI86900416	MN -80	11:11391
4347	NTIS, PC A05/MF A01 - GPO		TI86002835	MN -80	11:11235
4360-Vol.2	NTIS, PC A10/MF A01 - GPO		TI86002985	MN -47	11:11078
4364	NTIS, PC A10/MF A01 - GPO		TI86004031	MN -41	11:11334
4367	NTIS, PC A05/MF A01 - GPO		TI86001867	MN -80	11:11236
4378	NTIS, PC A04/MF A01 - GPO		TI86005112	MN -80	11:11335
4400	NTIS, PC A05/MF A01 - GPO		TI86004714	MN -78	11:11336
4422	NTIS, PC A06/MF A01 - GPO		TI86900460	MN -78	11:11524
4428	NTIS PC E04/MF $5.25 - GPO		TI86004708	MN -78	11:11337
4431	NTIS, PC A04/MF A01 - GPO		TI86004897	MN -11	11:11338
NUREG-tr-				
0015	NTIS, PC A17/MF A01 - GPO		TI85901904	MN -78	11:11359
0053	NTIS, PC A04/MF A01 - GPO		TI85901906	MN -78	11:11357
NYSERDA-				
85-14	Dept. of Communications, NYSERDA, Two Rockefeller Plaza, Albany, NY 12223		TI86900419	MN -12	11:11479
OCS/EIS/EA/MMS-				
85-0085-Vol.1	USDI - Minerals Management Service, 12203 Sunrise Valley Dr., Reston, VA 22091		TI86900378	MN -11	11:10938
OCS/EIS/MMS-				
85-0086	Minerals Management Service, Box 7944, Metairie, LA 70010		TI86900233	MN -11	11:10964
OEFZS-				
4323	NTIS (US Sales Only), PC A03/MF A01		DE86701211	MN -2	11:11230
ORNL-				
6121	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005342	STD -20c	11:11525
6184	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE86005339	MN -88	11:10918
6193-Vol.1	*See* NUREG/CR-4302-Vol.1		TI86003618	MN -78	11:11273
6208	*See* NUREG/CR-4367		TI86001867	MN -80	11:11236
6242	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE86004661	MN -25	11:11584
ORNL/CDIC-				
11	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004654	MN -11	11:11867
ORNL/ENG/TM-				
31-V2	*See* NUREG/CR-4360-Vol.2		TI86002985	MN -47	11:11078
ORNL/FEDC-				
85/ 6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004642	STD -20d	11:12442
ORNL/FETEP-				
15	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005344	MN -41	11:10922
ORNL/M-				
82	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004943	MN -11	11:12009
85	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004831	MN -38	11:11747
111	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005278	MN -41	11:11082

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
ORNL/PPA-					
85/ 2	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99:	DE86004590	MN -13	11:12514
ORNL/SGMP-					
85/ 2	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE86005338	MN -90c	11:10790
ORNL/Sub-					
79-24610/ 4	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004588	MN -95d	11:11447
79-42539/ 5	NTIS, PC A08/MF A01 (GPO Dep.)	E 1.99:	DE86005259	MN -95d	11:11448
84-89643/ 1	NTIS, PC A08/MF A01 (GPO Dep.)	E 1.99:	DE86004646	STD -97a	11:11856
85-27420/ 1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005260	MN -96	11:11488
7778/ 1	*See* NUREG/CR-2150		TI85015978	MN -78	11:11569
ORNL/TM-					
1168/ R2-Pt.2	NTIS, PC A13/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005340	MN -80	11:11288
5711/ R2	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE86004653	MN -80	11:11289
7967	*See* NUREG/CR-2344		TI85015991	MN -78	11:11229
9100	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005258	MN -13	11:11868
9545	*See* NUREG/CR-3634		TI86003557	MN -80	11:11328
9570/ V1	*See* NUREG/CR-4188-Vol.1		TI86004940	MN -80	11:11266
9688	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004647	STD -20g	11:12443
9689	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004638	STD -20g	11:12497
9704	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004645	STD -20f	11:12444
9706	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005345	MN -11	11:11869
9727	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86001366	MN -34C	11:12373
9739	*See* NUREG/CR-4347		TI86002835	MN -80	11:11235
9755	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005371	MN -10	11:10988
9758	NTIS, PC A12/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005257	MN -97b	11:11223
9767	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005114	MN -32	11:12386
9772	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004641	STD -20f	11:12445
9779	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004650	MN -4	11:11619
9809	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE86004659	MN -22	11:11113
9815	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE86005262	MN -90	11:10791
9820	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004657	MN -4	11:11721
9832	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005263	MN -61A	11:11163
9847	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004660	MN -96	11:11462
9862	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004651	MN -80	11:11285
9877	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004594	MN -70	11:11027
9880	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004597	MN -80	11:11290
9885	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004640	STD -20d	11:12498
ORNL-tr-					
5244	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004569	MN -41	11:12394
ORO-					
4014-15	*See* DOE/ER/04014-15	E 1.99:	DE86004469	MN -80	11:11282
PATENTS-US-	(US: Commissioner of Patents, Washington, D.C. 20231, USA, $1.00 per copy. Government Patent Applications available from NTIS)				
4,528,032					11:12510
4,528,078					11:11779
4,528,503					11:11172
4,532,149					11:11541
4,533,541					11:11982
4,535,639					11:10966
4,536,841					11:11838
4,537,064					11:11766
4,537,091					11:11495
4,537,249					11:11259
PB-					
85-235380/ XAB	NTIS, PC A05/MF A01				11:11150
85-235455/ XAB	NTIS, PC A04/MF A01				11:10810
85-235786/ XAB	NTIS, PC A02/MF A01				11:10923
85-236099/ XAB	NTIS, PC A02/MF A01				11:11870
85-236404/ XAB	NTIS, PC A03/MF A01				11:10823
85-236453/ XAB	NTIS, PC A03/MF A01				11:10924
85-236479/ XAB	NTIS, PC A03/MF A01				11:10925
85-236495/ XAB	NTIS, PC A02/MF A01				11:11896
85-236719/ XAB	NTIS, PC A02/MF A01				11:11915
85-236750/ XAB	NTIS, PC A13/MF A01				11:11909
85-237139/ XAB	NTIS, PC A03/MF A01				11:11154
85-237154/ XAB	NTIS, PC A03/MF A01				11:11919
85-237162/ XAB	NTIS, PC A03/MF A01				11:11920
85-237246/ XAB	NTIS, PC A03/MF A01				11:10939
85-237253/ XAB	NTIS, PC A02/MF A01				11:10940
85-237311/ XAB	NTIS MF A01				11:11377
85-237428/ XAB	NTIS, PC A02/MF A01				11:11916
85-237857/ XAB	NTIS, PC A04/MF A01				11:11871
85-237923/ XAB	NTIS, PC A04/MF A01				11:10811
85-238079/ XAB	NTIS, PC A99/MF A01				11:10941
85-238582/ XAB	NTIS, PC A09/MF A01				11:11498
85-239267/ XAB	NTIS, PC A05/MF A01				11:11883
85-239275/ XAB	NTIS, PC A06/MF A01				11:11884
85-239572/ XAB	NTIS, PC A20/MF A01				11:10942
85-239580/ XAB	NTIS, PC A20/MF A01				11:10943
85-239598/ XAB	NTIS, PC A19/MF A01				11:10944
85-239986/ XAB	NTIS, PC A03/MF A01				11:10824
85-240216/ XAB	NTIS, PC A08/MF A01				11:11195
85-240406/ XAB	NTIS, PC A04/MF A01				11:10926

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
85-241164/ XAB	NTIS, PC A06/MF A01				11:10954
85-242121/ XAB	NTIS, PC A05/MF A01				11:11483
85-242295/ XAB	NTIS, PC A06/MF A01				11:11885
85-242311/ XAB	NTIS, PC A05/MF A01				11:11999
85-242667/ XAB	NTIS, PC A09/MF A01				11:12026
85-243467/ XAB	NTIS, PC A03/MF A01				11:12024
85-243566/ XAB	NTIS, PC A10/MF A01				11:12027
85-243749/ XAB	NTIS, PC A05/MF A01				11:11143
85-244499/ XAB	NTIS, PC A99/MF A01				11:10945
85-244507/ XAB	NTIS, PC A99/MF A01				11:10946
85-244515/ XAB	NTIS, PC A23/MF A01				11:10947
85-244523/ XAB	NTIS, PC A99/MF A01				11:10948
85-244531/ XAB	NTIS, PC A99/MF A01				11:10949
85-244549/ XAB	NTIS, PC A21/MF A01				11:10950
85-244556/ XAB	NTIS, PC A99/MF A01				11:10951
85-244564/ XAB	NTIS, PC A99/MF A01				11:10952
85-246965/ XAB	NTIS, PC A11/MF A01				11:10968
85-247260/ XAB	NTIS, PC A99/MF A01				11:10953
PC/ICE/T-					
17	*See* PB-85-240216/XAB				11:11195
PFC/JA-					
85-37	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004402	MN -20	11:12446
PNL-					
3713	*See* NUREG/CR-1977		TI86004938	MN -41	11:11327
5509	*See* NUREG/CR-4297		TI86004937	MN -41	11:11998
5520	*See* NUREG/CR-4323		TI86005079	MN -70	11:11026
5576	*See* NUREG/CR-4378		TI86005112	MN -80	11:11335
5635	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005102	MN -70	11:11028
5658	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE86005492	MN -91	11:10969
5678	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004182	MN -94c	11:11371
PNL-SA-					
8261	NTIS, PC A02/MF A01 - GPO		TI85016694	MN -78	11:11339
8477	NTIS, PC A02/MF A01 - GPO		TI85016693	MN -78	11:11340
8757	NTIS, PC A02/MF A01 - GPO		TI85016696	MN -78	11:11237
9585	NTIS, PC A02/MF A01 - GPO		TI85016715	MN -78	11:11255
9938	NTIS, PC A02/MF A01 - GPO		TI85016716	MN -78	11:11238
9985	NTIS, PC A02/MF A01 - GPO		TI85016706	MN -78	11:11341
12608	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004864	MN -48	11:12025
12628	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004878	MN -90d	11:10792
12879	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004867	MN -70	11:11060
13028	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004862	MN -90i	11:11872
13062	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004869	MN -61D	11:11144
13120	NTIS, PC A02/MF A01 - GPO		TI86004024	MN -80	11:11270
13144	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004865	MN -95d	11:11449
13157	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004875	MN -90	11:10793
13233	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004868	MN -4	11:11620
13266	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004403	MN -90i	11:10927
13275	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004857	MN -25	11:11621
13284	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004877	MN -90d	11:10928
13318	NTIS, PC A02/MF A01 - GPO		TI86004022	MN -78	11:11342
13388	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004879	MN -41	11:11836
13419	NTIS, PC A02/MF A01 - GPO		TI86004025	MN -78	11:11256
13423	NTIS, PC A03/MF A01 - GPO		TI86002819	MN -78	11:11526
13453	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004866	MN -41	11:12000
13456	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE86004860	MN -70	11:11029
13471	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004863	MN -61D	11:11132
13507	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004870	MN -62	11:11177
13561	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004872	MN -41	11:12001
PPPL-					
2248	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005044	STD -20f	11:12447
2264	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005037	STD -20f	11:12448
2265	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005040	STD -20g	11:12449
2267	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005041	STD -20g	11:12450
2279	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005039	STD -20a	11:12499
2281	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005036	STD -20g	11:12451
2286	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005042	STD -20g	11:12452
2288	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005035	STD -20g	11:12500
2290	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE86005032	STD -20g	11:12453
2291	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005043	STD -20g	11:12454
PR-P-					
137	*See* AECL-8106		DE86700369	MN -34D	11:12138
PSI-FR-					
191	*See* ORNL/Sub-84-89643/1	E 1.99:	DE86004646	STD -97a	11:11856
RAL-					
85-014	NTIS (US Sales Only), PC A04/MF A01		DE86701192	MN -37	11:11837
REC-ERC-					
85-6	*See* PB-85-237139/XAB				11:11154
REG/G-					
5.62	US Nuclear Regulatory Commission, Washington, DC 20555		TI86900215	MN -80	11:11264
RHO-BW-SA-					
381-P	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004520	MN -70	11:11030
406-P	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005193	MN -70	11:11031

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
RHO-BW-ST-					
71-P	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005143	MN -70	11:12030
RHO-PB-SR-					
10-B-WM-Nov.85	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005175	MN -70	11:11032
10-B-WM-Oct.85	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004192	MN -70	11:11033
RHO-QA-SA-					
14	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86002896	MN -10	11:11622
RHO-WM-EV-					
9-P	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005235	MN -70	11:11079
12-P	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005174	MN -70	11:11034
RISLEY-Trans-					
4114	NTIS (US Sales Only), MF A01; 2		DE85902092	MN -79	11:11358
SAAS-					
323	NTIS (US Sales Only), PC A05/MF A01		DE86701199	MN -70	11:11035
SAND-					
80-0544C	NTIS, PC A02/MF A01 - GPO		TI85016663	MN -78	11:11343
81-0123C	NTIS, PC A02/MF A01 - GPO		TI85016664	MN -78	11:11344
81-0158C	NTIS, PC A02/MF A01 - GPO		TI85016666	MN -78	11:11345
81-0655C	NTIS, PC A03/MF A01 - GPO		TI85016713	MN -78	11:11346
81-0947C	NTIS, PC A02/MF A01 - GPO		TI85016712	MN -78	11:11347
81-1101C	NTIS, PC A02/MF A01 - GPO		TI85016704	MN -78	11:11348
82-2947	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005336	MN -70	11:12035
83-1293	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005334	MN -70	11:11585
83-2657	*See* NUREG/CR-4136		TI86003524	MN -80	11:11740
84-1007	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005335	MN -70	11:11559
84-1101	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99:	DE86005333	MN -70	11:12033
84-2598	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004968	MN -38	11:11742
85-0015	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86003987	MN -94c	11:11700
85-0380	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016832	MN -70	11:11061
85-0442	*See* NUREG/CR-4171		TI86005239	MN -78	11:11330
85-0576	*See* NUREG/CR-4189		TI86004715	MN -78	11:11331
85-0813	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004977	MN -13	11:11741
85-1199	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004976	MN -38	11:11774
85-1208C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004621	MN -25	11:11527
85-1287	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005105	MN -70	11:11038
85-1326	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004970	MN -92	11:10956
85-1335C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004606	MN -25	11:11528
85-1364C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004607	MN -20	11:12501
85-1425C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004604	MN -25	11:11586
85-1446	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE86003188	MN -94cb	11:11372
85-1558	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86003442	MN -94c	11:11218
85-1577C	NTIS, PC A02/MF A01 - GPO		TI86004276	MN -80	11:11349
85-1595	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE86004971	MN -32	11:12523
85-1606-1	*See* NUREG/CR-4340-1		TI86004757	MN -41	11:11333
85-1614C	NTIS, PC A02/MF A01 - GPO		TI86003930	MN -78	11:11350
85-1615C	NTIS, PC A02/MF A01 - GPO		TI86003931	MN -78	11:11351
85-1666C	NTIS, PC A02/MF A01 - GPO		TI86004275	MN -78	11:11352
85-1759	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004973	MN -70	11:11039
85-1886	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE86004853	MN -21	11:12502
85-2027	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005106	MN -92	11:10957
85-2060C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85018274	MN -38	11:11748
85-2121C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85018533	MN -38	11:11743
85-2606C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004987	MN -25	11:11587
85-2664C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004620	MN -25	11:11588
85-7185	*See* NUREG/CR-4214		TI85017968	MN -41	11:11997
85-7240	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005275	STD -71	11:10991
85-7242	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004229	STD -71	11:10992
85-7260	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004224	STD -71	11:11083
85-8178	NTIS, PC A06/MF A01; 1		DE86005064	MN -62	11:11155
85-8179	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005062	MN -62	11:11156
85-8245	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005061	MN -25	11:11529
85-8248	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005063	MN -32	11:12132
85-8249	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005066	MN -62a	11:11178
SERI/STR-					
211-2789	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016878	STD -63	11:11589
211-2804	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016893	STD -63	11:11164
211-2813	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016880	STD -63	11:11165
211-2814	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016886	STD -63	11:11166
211-2818	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016888	STD -63	11:11167
211-2831	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016887	STD -63	11:11168
211-2845	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016875	STD -63	11:11169
231-2799	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85016889	MN -61	11:11170
SKB-SP-TR-					
85-03	NTIS (US Sales Only), PC A08/MF A01		DE86700485	MN -51	11:11903
SLAC-					
289	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004700	STD -34D	11:12163
SLAC/AP-					
47	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005085	MN -28	11:11790
SR-					
85-9	*See* DOE/ER/60149-1	E 1.99:	DE86004999	MN -11	11:11857
SRDP-R-					
119	NTIS (US Sales Only), PC A02/MF A01		DE86701203	MN -16	11:11084
SRO-					
819-16	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005256	MN -11	11:11921

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
SSI-					
85-08	NTIS (US Sales Only), PC A04/MF A01		DE86700486	MN -51	11:12392
SWRI-					
7670	*See* PB-85-238582/XAB				11:11498
TC-SR-					
2	*See* IAEA-TC-427/6		DE86780327	MN -4	11:11644
TPR-NS-					
25-No.4	GPO, $6.50		TI84014483	ND -41	11:11353
TR-					
2	*See* AD-A-157940/8/XAB				11:11638
8	*See* AD-A-157945/7/XAB				11:11361
0084(4613) -1	*See* AD-A-157832/7/XAB				11:12053
TR-EL-					
82-4	NTIS, PC A03/MF A01		TI86900191	MN -11	11:11910
82-4/ 82-11.40	NTIS, PC A03/MF A01		TI86900199	MN -11	11:11911
TRI-PP-					
82-31	NTIS (US Sales Only), PC A02/MF A01		DE86700468	MN -4	11:11723
83-87	NTIS (US Sales Only), PC A02/MF A01		DE86700469	MN -4	11:11724
83-88	NTIS (US Sales Only), PC A02/MF A01		DE86700345	MN -34A	11:12090
83-93	NTIS (US Sales Only), PC A02/MF A01		DE86700376	MN -34D	11:12206
83-95	NTIS (US Sales Only), PC A02/MF A01		DE86700311	MN -34D	11:12409
83-98	NTIS (US Sales Only), PC A02/MF A01		DE86700346	MN -34A	11:12091
85-1	NTIS (US Sales Only), PC A02/MF A01		DE86700452	MN -34C	11:12344
85-3	NTIS (US Sales Only), PC A02/MF A01		DE86700325	MN -34D	11:12253
85-4	NTIS (US Sales Only), PC A02/MF A01		DE86700326	MN -34D	11:12254
85-5	NTIS (US Sales Only), PC A02/MF A01		DE86700379	MN -34D	11:12207
85-6	NTIS (US Sales Only), PC A02/MF A01		DE86700436	MN -34C	11:12304
85-7	NTIS (US Sales Only), PC A02/MF A01		DE86700327	MN -34D	11:12255
85-9	NTIS (US Sales Only), PC A02/MF A01		DE86700437	MN -34C	11:12305
85-10	NTIS (US Sales Only), PC A02/MF A01		DE86700378	MN -34D	11:12208
85-28	NTIS (US Sales Only), PC A02/MF A01		DE86900324	MN -34C	11:12288
85-64	NTIS (US Sales Only), PC A02/MF A01		DE86900368	MN -34C	11:12374
85-72	NTIS (US Sales Only), PC A02/MF A01		DE86900366	MN -34D	11:12164
TTC-					
0607	*See* SAND-85-7260	E 1.99:	DE86004224	STD -71	11:11083
0608	*See* SAND-85-7242	E 1.99:	DE86004229	STD -71	11:10992
0609	*See* SAND-85-7240	E 1.99:	DE86005275	STD -71	11:10991
UCID-					
20297-85-4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005088	MN -90a	11:11764
20495	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86003182	STD -94c	11:11373
20549	*See* NUREG/CR-4431		TI86004897	MN -11	11:11338
20569	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005292	MN -20	11:12503
20592	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004902	MN -38	11:11749
20615	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004907	MN -28	11:11791
20619	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004906	MN -21	11:12504
UCRL-					
15535-Vol.7	NTIS PC A05/MF A01		DE83012950	MN -66	11:11200
50021-84	NTIS, PC A21/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005297	STD -21	11:12505
52000-85-11	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86005295	STD -2	11:11758
53542	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005305	STD -11	11:12032
53609	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005291	STD -91	11:10970
53633	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005296	STD -20f	11:12506
53648	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005302	STD -32	11:12524
84191	NTIS, PC A02/MF A01 - GPO		TI85016668	MN -78	11:11354
92514	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005082	MN -20	11:12455
92557	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004236	MN -21	11:12507
93415	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004919	MN -11	11:11886
93471	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86003492	MN -34A	11:12092
93686	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004238	MN -20a	11:12456
93699	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004239	MN -20f	11:12457
UCRL-Trans-					
12081	NTIS, PC A05; 3		DE86004813	MN -4	11:11698
UDR-TR-					
83-97-VOL-2	*See* AD-A-158772/4/XAB				11:11603
UFPB-DF-					
10/ 84	NTIS (US Sales Only), PC A03/MF A01		DE86700312	MN -34D	11:12410
11/ 84	NTIS (US Sales Only), PC A02/MF A01		DE86700313	MN -34D	11:12411
12/ 84	NTIS (US Sales Only), PC A02/MF A01		DE86700314	MN -34D	11:12412
13/ 84	NTIS (US Sales Only), PC A02/MF A01		DE86700342	MN -34A	11:12093
14/ 84	NTIS (US Sales Only), PC A02/MF A01		DE86700366	MN -34B	11:12043
15/ 84	NTIS (US Sales Only), PC A02/MF A01		DE86700328	MN -34D	11:12256
16/ 84	NTIS (US Sales Only), PC A02/MF A01		DE86700329	MN -34D	11:12257
17/ 84	NTIS (US Sales Only), PC A02/MF A01		DE86700315	MN -34D	11:12413
UM-P-					
84/ 70	NTIS (US Sales Only), PC A02/MF A01		DE86700400	MN -34D	11:12209
84/ 72	NTIS (US Sales Only), PC A02/MF A01		DE86700406	MN -34D	11:12210
USGS-OFR-					
85-620	NTIS, PC A04/MF A01; 1		DE86900530	MN -11	11:12031
USGS/WRI-					
85-4030	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86004490	STD -70	11:11040
USIP-					
85-09	NTIS (US Sales Only), PC A02/MF A01		DE86700407	MN -34D	11:12211
UWFDM-					
633	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004845	MN -20d	11:12508

Report Number	*Availability Source*	*File Number*		*Distribution Category*	*Abstract Number*
640	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004755	MN -20c	11:11530
UWIS/DC/TR-					
85/ 1	*See* AD-A-158759/1/XAB				11:11571
WP-					
738	*See* PB-85-237311/XAB				11:11377
WTSD-TME-					
2970	NTIS, PC A02; 3		DE86004317	MN -70	11:11041
3106(Vol.1)	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86004322	MN -70	11:11042
3106-Vol.2	NTIS, PC A20/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004336	MN -70	11:11043
3148	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004343	MN -70	11:11044
3151	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004344	MN -70	11:11923
3159	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004339	MN -70	11:11045
XN-NF-					
85-41	*See* DOE/ET/34215-37	E 1.99:	DE86004189	STD -78	11:11232
ZfI-Mitt-					
97	NTIS (US Sales Only), PC A18/MF A01		DE86700470	MN -4	11:11713
98	NTIS (US Sales Only), PC A18/MF A01		DE86700471	MN -4	11:11714
ZfK-					
524	NTIS (US Sales Only), PC A24/MF A01		DE86700458	MN -4	11:11623

FILE NUMBER CORRELATION

This correlation list is provided for those organizations where document storage is alphanumeric by report number and request may be received by file number. For other information about a document (abstract number, distribution category, availability, and price), please refer to the Report Number Index.

File No.	*Report No.*
DE83012950	UCRL—15535-Vol.7
DE83902446	JAERI-M—83-041
DE85012880	DOE/MC/20122—2
DE85015233	CONF-8410103—
DE85015851	EGG/LTR—17-50
DE85016413	CONF-850610—35
DE85016832	SAND—85-0380
DE85016875	SERI/STR—211-2845
DE85016878	SERI/STR—211-2789
DE85016880	SERI/STR—211-2813
DE85016886	SERI/STR—211-2814
DE85016887	SERI/STR—211-2831
DE85016888	SERI/STR—211-2818
DE85016889	SERI/STR—231-2799
DE85016893	SERI/STR—211-2804
DE85017540	LA-UR—85-2991
DE85018251	DOE/SF/00893—T24
DE85018259	DOE/CL/02395—T9
DE85018274	SAND—85-2060C
DE85018533	SAND—85-2121C
DE85902092	RISLEY-Trans—4114
DE86000318	K/OA—226
DE86000320	CONF-851050—Absts.
DE86000350	DOE/R9/50021—T1
DE86000353	DOE/R1/10004—T1
DE86000564	DOE/PE/77000—1
DE86000823	DOE/ET/17086—1932
DE86000864	DOE/ER/05224—9
DE86001011	DOE/MC/21088—1964
DE86001015	DOE/MC/19352—1763
DE86001021	DOE/METC—86/6030
DE86001045	DOE/MC/16433—1977
DE86001047	DOE/MC/14593—1981
DE86001165	DOE/ER/10712—5
DE86001357	CONF-8508105—6
DE86001366	ORNL/TM—9727
DE86001557	CONF-8510118—
DE86001615	CONF-8509154—Summs.
DE86002047	DOE/IR/10425—T2
DE86002445	LA-UR—85-3733
DE86002494	DOE/ER/51089—T1
DE86002503	BNL—36756
DE86002829	DOE/PC/70788—T3
DE86002896	RHO-QA-SA—14
DE86002897	LBL—19395
DE86002949	DOE/ER/03409—T2
DE86002967	LBL—20025
DE86002973	DOE/ER/30063—T1-Vol.1
DE86002974	DOE/ER/30063—T2-Vol.2-App.
DE86002975	DOE/ER/30063—T3-Vol.3
DE86003020	CONF-851146—Summs.
DE86003025	DOE/OR/00033—T166
DE86003061	ANL-HEP-CP—85-103
DE86003074	CONF-851048—11
DE86003092	CONF-8510248—1
DE86003116	DOE/EI/19680—T2
DE86003182	UCID—20495
DE86003187	DOE/NASA—1005-7
DE86003188	SAND—85-1446
DE86003202	DOE/NASA/50112—60
DE86003283	LA—10516-MS
DE86003295	ANL/SPG—26
DE86003380	BNL—37156
DE86003381	BNL—37162
DE86003431	CONF-851192—1
DE86003442	SAND—85-1558
DE86003459	DOE/ER/03948—T4
DE86003484	DOE/ET/25102—T1
DE86003485	CONF-850956—Absts.
DE86003492	UCRL—93471
DE86003670	LA-UR—85-4009
DE86003827	DOE/PC/60813—9
DE86003851	DOE/ER/01067—24
DE86003871	DOE/PC/70768—3
DE86003878	DOE/PC/71257—T4
DE86003879	LA-tr—84-22-Rev.
DE86003908	DOE/PC/70764—3
DE86003909	DOE/PC/30248—T2
DE86003912	DOE/FE/60181—176
DE86003932	DOE/PC/60046—7
DE86003942	DOE/PC/80752—T2
DE86003944	DOE/PC/70764—4
DE86003987	SAND—85-0015
DE86004015	HEDL-SA—3348-FP
DE86004036	CONF-851192—2
DE86004045	CONF-860205—3
DE86004046	CONF-8507103—1
DE86004057	CONF-851146—2
DE86004058	CONF-851146—3
DE86004065	CONF-851115—42
DE86004074	CONF-8509142—
DE86004110	EGG-PBS—6798
DE86004115	EGG-M—23085
DE86004120	EGG-M—18485
DE86004153	EGG-M—27785
DE86004156	LA—10513-PR
DE86004157	DOE/PC/81205—T1
DE86004171	CONF-8410315—
DE86004174	LA—10550-C
DE86004178	ANL/OEPM—85-4
DE86004182	PNL—5678
DE86004189	DOE/ET/34215—37
DE86004192	RHO-PB-SR—10-B-WM-Oct.85
DE86004198	DOE/DP/40124—75
DE86004199	DOE/DP/40124—76
DE86004200	CONF-8510245—1
DE86004202	CONF-850871—22
DE86004204	CONF-8508153—1
DE86004207	DOE/ER/10339—2-Final
DE86004213	DOE/OR/21400—T213
DE86004215	DOE/RL/01830—T40
DE86004224	SAND—85-7260
DE86004229	SAND—85-7242
DE86004236	UCRL—92557
DE86004238	UCRL—93686
DE86004239	UCRL—93699
DE86004245	DOE/ER/10250—T5
DE86004246	DOE/ER/10250—T7
DE86004247	DOE/ER/10250—T6
DE86004262	DOE/PC/80512—T3
DE86004263	DOE/PC/70800—T3
DE86004271	DOE/PC/50801—12
DE86004272	DOE/PC/70776—T5
DE86004273	DOE/PC/81504—T2
DE86004279	DOE/ER—0252
DE86004285	DOE/ER/52082—1
DE86004287	DOE/ER/40048—33-N5
DE86004291	DOE/ER/40124—7
DE86004292	DOE/DP/40203—1
DE86004294	DOE/ER/04991—5
DE86004295	DOE/MC/49941—1833
DE86004296	DOE/ER/60068—2
DE86004297	DOE/ER/40048—30-N5
DE86004298	DOE/ER/40048—25-N5
DE86004304	DOE/ER/40048—03-N6
DE86004305	DOE/ER/40048—148-N5
DE86004317	WTSD-TME—2970
DE86004322	WTSD-TME—3106(Vol.1)
DE86004336	WTSD-TME—3106-Vol.2
DE86004339	WTSD-TME—3159
DE86004343	WTSD-TME—3148
DE86004344	WTSD-TME—3151
DE86004349	DOE/PC/60801—8
DE86004355	BNL—37221
DE86004358	DOE/PC/62999—8
DE86004387	DOE/PC/70814—5
DE86004391	DOE/ER/60351—T1
DE86004395	EPRI-EM—4341
DE86004398	DOE/ER/10371—7
DE86004401	DOE/ET/51013—T7
DE86004402	PFC/JA—85-37
DE86004403	PNL-SA—13266
DE86004404	DOE/ER/45173—1-1985
DE86004407	DOE/ER/04721—9
DE86004408	DOE/ER/60005—T2
DE86004410	DOE/ER/03072—28
DE86004469	DOE/ER/04014—15
DE86004471	DOE/ER/04699—9
DE86004474	DOE/ER/60040—02
DE86004479	DOE/PC/70780—T3
DE86004484	DOE/ER/80010—T2
DE86004487	DOE/RW—0038-Draft
DE86004490	USGS/WRI—85-4030
DE86004502	DOE/ER/60154—1
DE86004504	DOE/ER/10909—1
DE86004505	DOE/CS/30350—T3
DE86004506	DOE/ER/10705—10
DE86004507	DOE/ER/10618—19
DE86004508	DOE/ER/45072—18
DE86004513	DOE/PC/60802—T4
DE86004514	DOE/PC/60802—T6
DE86004515	DOE/PC/60802—T5
DE86004518	DOE/OR/21558—1
DE86004520	RHO-BW-SA—381-P
DE86004521	DOE/EIA—0035(85/09)
DE86004522	DOE/EIA—0130(85/10)
DE86004523	DOE/ER/13192—12
DE86004524	DOE/FE/60334—T1
DE86004527	DOE/ET/52048—32
DE86004529	DOE/OR/20917—T1
DE86004530	BMI—2133
DE86004531	CERN-EP—85-192
DE86004535	DOE/NE—0025/4
DE86004541	DOE/EIA—0109(85/10)
DE86004544	DOE/PC/60804—T9
DE86004550	DOE/PC/60798—9
DE86004551	DOE/PC/70812—5
DE86004553	DOE/ER—0253
DE86004559	DOE/PC/70809—T4
DE86004560	DOE/NASA/0255—1
DE86004561	DOE/ET/53088—198
DE86004562	DOE/ET/53088—212

File No.	Report No.
DE86004563	DOE/ET/53088—216
DE86004564	DOE/ET/53088—218
DE86004569	ORNL-tr—5244
DE86004588	ORNL/Sub—79-24610/4
DE86004590	ORNL/PPA—85/2
DE86004594	ORNL/TM—9877
DE86004597	ORNL/TM-—9880
DE86004602	DOE/LLW—18T-Rev.6
DE86004604	SAND—85-1425C
DE86004606	SAND—85-1335C
DE86004607	SAND—85-1364C
DE86004614	DP-MS—85-105
DE86004620	SAND—85-2664C
DE86004621	SAND—85-1208C
DE86004624	DP-MS—85-116
DE86004631	DOE/ER/60304—1
DE86004633	DOE/MC/21119—T4
DE86004635	DOE/ER/45055—15
DE86004638	ORNL/TM—9689
DE86004640	ORNL/TM—9885
DE86004641	ORNL/TM—9772
DE86004642	ORNL/FEDC—85/6
DE86004645	ORNL/TM—9704
DE86004646	ORNL/Sub—84-89643/1
DE86004647	ORNL/TM—9688
DE86004650	ORNL/TM—9779
DE86004651	ORNL/TM—9862
DE86004653	ORNL/TM—5711/R2
DE86004654	ORNL/CDIC—11
DE86004657	ORNL/TM—9820
DE86004659	ORNL/TM—9809
DE86004660	ORNL/TM—9847
DE86004661	ORNL—6242
DE86004664	BMI/ONWI—569
DE86004675	DOE/ER/60354—T1
DE86004682	CONF-851174—24
DE86004690	DOE/ER/13150—T2
DE86004691	DOE/ER/10714—5
DE86004693	DOE/ER/13175—7
DE86004695	FNAL-TM—1368
DE86004696	FNAL-TM—1360
DE86004699	FNAL-TM—1369
DE86004700	SLAC—289
DE86004706	DOE/ER/10452—15
DE86004709	DOE/ER/45162—1
DE86004718	LA-UR—85-3988
DE86004725	LA-UR—85-4176
DE86004731	LA-UR—85-4262
DE86004732	LA-UR—85-4263
DE86004733	LA-UR—85-4265
DE86004736	LA-UR—85-4307
DE86004740	LA-UR—85-4331
DE86004741	LA-UR—85-4332
DE86004742	LA-UR—85-4335
DE86004746	LA-UR—85-4404
DE86004749	LA-UR—85-4448
DE86004750	LA-UR—85-4451
DE86004752	LA-UR—85-4472
DE86004754	DOE/ER—0255
DE86004755	UWFDM—640
DE86004758	CONF-851102—59
DE86004761	CONF-851113—2
DE86004765	CONF-851102—52
DE86004767	CONF-851102—53
DE86004769	CONF-851202—2
DE86004771	CONF-851217—21
DE86004773	AI/DS/TR—1010-1
DE86004774	DOE/ER/10452—14
DE86004778	CONF-851068—4
DE86004779	CONF-851102—55
DE86004782	CONF-8511131—2
DE86004783	CONF-8510209—3
DE86004785	CONF-8509207—8
DE86004787	CONF-851202—1
DE86004789	CONF-851202—3
DE86004790	CONF-8510168—5
DE86004793	CONF-851102—58
DE86004794	CONF-8505223—1
DE86004795	CONF-8511140—1
DE86004796	CONF-851021—1
DE86004797	CONF-851217—15
DE86004798	CONF-851201—8
DE86004799	CONF-8511136—3
DE86004804	CONF-851217—22
DE86004805	CONF-851102—57
DE86004806	CONF-841218—29
DE86004807	CONF-841293—1
DE86004808	CONF-841246—30
DE86004810	CONF-841202—4
DE86004813	UCRL-Trans—12081
DE86004815	DOE/MC/20122—4
DE86004819	DOE/EV/01340—17
DE86004826	DOE/DP/40200—18
DE86004831	ORNL/M—85
DE86004833	BNL—51943
DE86004834	DOE/ER/52068—T10
DE86004838	DOE/ER/52068—T11
DE86004845	UWFDM—633
DE86004846	DOE/ER/04699—T2
DE86004849	DOE/ET/11304—35
DE86004851	GA-A—18149
DE86004853	SAND—85-1886
DE86004854	GA-A—18241
DE86004857	PNL-SA—13275
DE86004860	PNL-SA—13456
DE86004862	PNL-SA—13028
DE86004863	PNL-SA—13471
DE86004864	PNL-SA—12608
DE86004865	PNL-SA—13144
DE86004866	PNL-SA—13453
DE86004867	PNL-SA—12879
DE86004868	PNL-SA—13233
DE86004869	PNL-SA—13062
DE86004870	PNL-SA—13507
DE86004872	PNL-SA—13561
DE86004875	PNL-SA—13157
DE86004877	PNL-SA—13284
DE86004878	PNL-SA—12628
DE86004879	PNL-SA—13388
DE86004885	DOE/CE/50070—T6
DE86004890	EGG—10282-1081
DE86004893	DP-MS—85-117
DE86004895	DOE/DP/40124—50
DE86004896	DOE/PETC/TR—86/2
DE86004901	DOE/CE/50043—1
DE86004902	UCID—20592
DE86004904	DOE/WIPP—221
DE86004906	UCID—20619
DE86004907	UCID—20615
DE86004908	DOE/AL/05346—T6-Vol.1
DE86004909	DOE/AL/05346—T6-Vol.2
DE86004910	DOE/AL/05346—T6-Vol.5
DE86004911	DOE/AL/05346—T6-Vol.4
DE86004912	DOE/AL/05346—T6-Vol.3
DE86004919	UCRL—93415
DE86004921	DOE/EV/00890—9
DE86004925	DOE/CS/30522—1
DE86004926	DOE/EIA—0125(85/3Q)
DE86004928	DOE/DP/40200—01-Vol.21
DE86004929	DOE/DP/40200—02-Vol.22
DE86004930	DOE/DP/40200—03-Vol.23
DE86004931	DOE/DP/40200—04-Vol.24
DE86004932	K/OA—5951
DE86004933	DOE/FE/60177—1993
DE86004943	ORNL/M—82
DE86004948	NIPER—B06717-1
DE86004951	DOE/ER/45193—T1
DE86004952	DOE/CE/40659—1
DE86004953	DOE/ER/45057—1
DE86004954	DOE/PETC/QTR—85/3
DE86004955	DOE/ER/45062—T1
DE86004962	CONF-850869—12
DE86004964	DOE/ER/60351—1
DE86004965	ANL/EES-TM—292
DE86004966	ANL/MCS-TM—60
DE86004968	SAND—84-2598
DE86004970	SAND—85-1326
DE86004971	SAND—85-1595
DE86004973	SAND—85-1759
DE86004976	SAND—85-1199
DE86004977	SAND—85-0813
DE86004978	DOE/CS/30350—T2
DE86004980	DOE/CS/30350—T1
DE86004981	DOE/CS/30350—T4
DE86004983	DOE/NBM—6004983
DE86004987	SAND—85-2606C
DE86004992	DOE/EV/01340—T4
DE86004993	DOE/EV/01340—T5
DE86004994	DOE/EV/01340—15
DE86004995	DOE/EV/01340—14
DE86004996	DOE/ER/13191—2
DE86004998	DOE/ER/45078—1-1985
DE86004999	DOE/ER/60149—1
DE86005002	LA-tr—85-36
DE86005003	LA-tr—86-1
DE86005005	BCRNL-L—1525
DE86005007	HW—32041
DE86005008	HW—67729
DE86005009	HW—48356
DE86005010	EGG—2427
DE86005011	EGG—2429
DE86005012	DOE/NASA—0340-1
DE86005013	DOE/NASA—0363-1
DE86005015	DOE/ER/13329—1
DE86005017	CONF-851201—10
DE86005020	CONF-8510168—6
DE86005026	CONF-8510218—3
DE86005028	CONF-851102—60
DE86005032	PPPL—2290
DE86005033	DOE/NV/10250—23
DE86005035	PPPL—2288
DE86005036	PPPL—2281
DE86005037	PPPL—2264
DE86005039	PPPL—2279
DE86005040	PPPL—2265
DE86005041	PPPL—2267
DE86005042	PPPL—2286
DE86005043	PPPL—2291
DE86005044	PPPL—2248
DE86005045	DOE/NASA—0312-1
DE86005050	BNL—37316
DE86005051	BNL—37294
DE86005052	BNL—37234
DE86005055	BNL—37310
DE86005056	BNL—37301
DE86005057	BNL—37296
DE86005058	BNL—37314
DE86005059	DOE/ER/03077—267
DE86005060	DOE/ER/40085—9
DE86005061	SAND—85-8245
DE86005062	SAND—85-8179
DE86005063	SAND—85-8248
DE86005064	SAND—85-8178
DE86005065	DOE/ID/12129—1
DE86005066	SAND—85-8249
DE86005067	DOE/RA/50219—T7
DE86005070	DOE/ER/13023—2
DE86005071	DOE/ER/02289—13
DE86005072	DOE/CS/20524—7
DE86005082	UCRL—92514
DE86005085	SLAC/AP—47
DE86005088	UCID—20297-85-4
DE86005092	DOE/ET/10069—T119
DE86005098	EGG—10282-2082
DE86005099	DOE/NASA/51044—37
DE86005102	PNL—5635
DE86005104	DOE/MA—0142/2
DE86005105	SAND—85-1287
DE86005106	SAND—85-2027
DE86005107	DOE/LLW—31T
DE86005109	K—2057
DE86005110	DOE/EIA—0131(84)/1
DE86005111	DOE/EIA—0131(84)/2
DE86005114	ORNL/TM—9767
DE86005115	DOE/ER/60186—6
DE86005120	ANL—85-70
DE86005121	IAEA-SM—247/19
DE86005122	LBL-PUB—490
DE86005124	DOE/ER/10969—T1
DE86005126	DOE/EIA—0208(86-02)
DE86005129	DOE/PC/81003—T1
DE86005139	DOE/EV/00901—T5
DE86005141	DOE/ER/45168—2
DE86005143	RHO-BW-ST—71-P
DE86005145	DOE/MA—0196
DE86005147	DOE/OR/21400—T216
DE86005149	CONF-8509121—26
DE86005152	DOE/IG—0223
DE86005161	CONF-8510195—2
DE86005162	CONF-850925—2
DE86005163	CONF-851202—5
DE86005168	DOE/PC/80913—1
DE86005174	RHO-WM-EV—12-P
DE86005175	RHO-PB-SR—10-B-WM-Nov.85

File No.	Report No.
DE86005191	LBL—20627
DE86005193	RHO-BW-SA—406-P
DE86005212	LBL—19667
DE86005213	LBL—20166
DE86005221	LBL—19540
DE86005225	LBL—20626
DE86005229	LBL—19380
DE86005233	DOE/CE/40606—T3
DE86005235	RHO-WM-EV—9-P
DE86005242	DOE/EIA—0218(86/01)
DE86005247	BNL—37377
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DE86005256	SRO—819-16
DE86005257	ORNL/TM—9758
DE86005258	ORNL/TM—9100
DE86005259	ORNL/Sub—79-42539/5
DE86005260	ORNL/Sub—85-27420/1
DE86005262	ORNL/TM—9815
DE86005263	ORNL/TM—9832
DE86005264	DOE/RW—0006-Rev.1
DE86005265	BNL—37327
DE86005270	BNL—37356
DE86005271	DOE/PC/70018—13
DE86005275	SAND—85-7240
DE86005278	ORNL/M—111
DE86005282	EGG-EA—7116
DE86005290	DOE/RA/12117—5
DE86005291	UCRL—53609
DE86005292	UCID—20569
DE86005293	BNL—51871
DE86005295	UCRL—52000-85-11
DE86005296	UCRL—53633
DE86005297	UCRL—50021-84
DE86005300	BNL—51940
DE86005302	UCRL—53648
DE86005303	BNL—51927
DE86005305	UCRL—53542
DE86005317	EGG-PHY—7086
DE86005333	SAND—84-1101
DE86005334	SAND—83-1293
DE86005335	SAND—84-1007
DE86005336	SAND—82-2947
DE86005337	DP—1713
DE86005338	ORNL/SGMP—85/2
DE86005339	ORNL—6184
DE86005340	ORNL/TM—1168/R2-Pt.2
DE86005342	ORNL—6121
DE86005343	DP—1708
DE86005344	ORNL/FETEP—15
DE86005345	ORNL/TM—9706
DE86005350	DOE/ID/12532—1
DE86005358	EPRI-EA—4318-Vol.1
DE86005359	EPRI-EA—4318-Vol.2
DE86005360	EPRI-EA—4318-Vol.3
DE86005361	EPRI-EA—4318-Vol.4
DE86005362	EPRI-EA—4318-Vol.5
DE86005363	EPRI-EA—4318-Vol.6
DE86005364	EPRI-EA—4318-Vol.7
DE86005370	DOE/EI/19658—1
DE86005371	ORNL/TM—9755
DE86005381	LBL—20560
DE86005390	DOE/NBM—6005390
DE86005391	DOE/FE—0052
DE86005395	DOE/RW—0040
DE86005396	DOE/RW—0043
DE86005397	DOE/PETC/TR—86/3
DE86005399	DOE/ET/53088—202
DE86005400	DOE/ET/53088—214
DE86005401	DOE/ET/53088—219
DE86005403	DOE/ET/53088—223
DE86005423	DOE/DP—0027
DE86005492	PNL—5658
DE86005498	DOE/ID/12509—1
DE86005507	DOE/ER/13152—1
DE86005511	DOE/ER/45150—1
DE86005522	DOE/RW—0045
DE86005523	ANL/FE—85-9
DE86700301	IC—85/13
DE86700302	IC—85/9
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DE86700305	IFUSP-P—454
DE86700306	IFUSP-P—468
DE86700307	IFUSP-P—470
DE86700308	IFUSP-P—491
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DE86700312	UFPB-DF—10/84
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DE86700324	JINR—R-2-85-6
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DE86700348	IC—85/15
DE86700349	IC—85/23
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DE86700351	CBPF-NF—029/84
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DE86700353	IFUSP-P—452
DE86700354	IFUSP-P—474
DE86700355	IFUSP-P—479
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DE86700357	IFUSP-P—496
DE86700358	AAEC/E—592
DE86700360	IFUSP-P—503
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DE86700378	TRI-PP—85-10
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DE86700380	IFVE-ONF—84-21
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DE86700396	JINR—E-2-84-606
DE86700397	JINR—R-2-84-534
DE86700398	JINR—R-2-85-106
DE86700399	JINR—R-2-85-30
DE86700400	UM-P—84/70
DE86700401	IFUSP-P—455
DE86700402	IFUSP-P—486
DE86700403	IFUSP-P—492
DE86700404	IFVE-OTF—83-85
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DE86700406	UM-P—84/72
DE86700407	USIP—85-09
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DE86700412	JINR—R-4-85-45
DE86700415	IFUSP-P—457
DE86700416	IFUSP-P—458
DE86700417	IFUSP-P—462
DE86700418	IFUSP-P—464
DE86700419	IFUSP-P—465
DE86700420	IFUSP-P—469
DE86700421	IFUSP-P—472
DE86700422	IFUSP-P—473
DE86700423	IFUSP-P—477
DE86700424	IFUSP-P—487
DE86700425	IFUSP-P—500
DE86700426	IFUSP-P—506
DE86700427	ITEP—183(1984)
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DE86700433	IFUSP-P—451
DE86700434	IFUSP-P—459
DE86700435	JINR—E-4-84-618
DE86700436	TRI-PP—85-6
DE86700437	TRI-PP—85-9
DE86700438	ANU-P—904
DE86700439	ANU-P—908
DE86700440	IFUSP-P—460
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DE86700442	JINR—R-7-84-358
DE86700443	ANU-P—926
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DE86700448	JINR—R-3-85-74
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DE86700450	ANU-P—905
DE86700451	ANU-P—915
DE86700452	TRI-PP—85-1
DE86700453	AECL—8184
DE86700454	IFUSP-P—497
DE86700455	IFUSP-P—498
DE86700456	INDC(CCP)—238
DE86700457	ARL/TR—068
DE86700458	ZfK—524
DE86700459	INFO—0128-1
DE86700460	NUCLEBRAS-CDTN—465
DE86700462	CBPF-NF—008/84
DE86700463	IAEA-TECDOC—337
DE86700464	INFO—0133
DE86700465	CNEA-NT—14/83
DE86700466	AAEC/E—599
DE86700467	JINR—6-84-609
DE86700468	TRI-PP—82-31
DE86700469	TRI-PP—83-87
DE86700470	Zfl-Mitt—97
DE86700471	Zfl-Mitt—98
DE86700472	AECL—8256
DE86700473	INFO—0143
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DE86700476	AECL—8368
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DE86700478	IC—85/5
DE86700479	IC—85/6
DE86700480	NAK—3
DE86700481	IC—85/21
DE86700483	ARL/TR—070
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File No.	Report No.
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DE86701192	RAL—85-014
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DE86701210	INDC(NDS)—159/LNA
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DE86750046	CRN-PN—84-37
DE86750048	ISN—83-54
DE86750106	CEA-CONF—7902
DE86750310	ISN—83-66
DE86750311	CNRS-CPT—84-PE-1712
DE86750312	LYCEN—8462
DE86750313	CNRS-CPT—84-P-1699
DE86750314	LPC—84-19
DE86750315	IPNO-TH—84-65
DE86750316	IPNO-TH—83-19
DE86750317	ISN—85-02
DE86750318	CENBG—8425
DE86750319	IPNO-TH—84-66
DE86750320	ISN—84-36
DE86750321	IPNO-TH—84-46
DE86750322	CEA-CONF—7833
DE86750323	CEA-CONF—7832
DE86750324	CEA-CONF—7831
DE86750326	FRNC-TH—1771
DE86750327	FRNC-TH—1428
DE86750329	CEA-CONF—7344
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DE86750333	ISN—84-31
DE86750334	ISN—84-32
DE86750335	CNRS-CPT—84-P-1709
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DE86750348	LYCEN—8346
DE86750349	CENBG—8429
DE86750350	CEA-CONF—7777
DE86750351	CNRS-CPT—84-PE-1703
DE86750352	LYCEN—8437
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DE86750354	CEA-CONF—7691
DE86750355	CEA-CONF—7796
DE86750356	CEA-CONF—7801
DE86750357	CEA-CONF—7800
DE86750358	CEA-CONF—7805
DE86750359	CEA-CONF—7792
DE86750360	CEA-CONF—7779
DE86750361	CEA-CONF—7778
DE86750362	CEA-CONF—7509
DE86750363	CEA-CONF—7559
DE86750364	CEA-CONF—7420
DE86750365	CEA-CONF—7709
DE86750366	IPNO-TH—83-67
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DE86750368	CEA-CONF—7794
DE86750369	CEA-CONF—7823
DE86750370	LAL-RT—84-06
DE86750371	CEA-CONF—7879
DE86750372	LAL-RT—84-05
DE86750373	CEA-CONF—7822
DE86750374	LAL-RT—84-13
DE86750375	CEA-CONF—7793
DE86750376	CEA-CONF—7821
DE86750377	LAL-RT—84-04
DE86750378	CEA-CONF—7900
DE86750379	CEA-CONF—7795
DE86750380	FRNC-TH—2063
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DE86750383	CEA-CONF—7705
DE86750384	CEA-CONF—7704
DE86750385	CEA-CONF—7684
DE86750386	CEA-CONF—7706
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DE86750389	CEA-N—2411-Vol.1
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DE86780351	INIS-mf—9822
DE86780352	INIS-mf—9823
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DE86900360	CONF-8111235—1
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TI85016704	SAND—81-1101C
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TI85016716	PNL-SA—9938
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TI86001170	BNL-NUREG—36985
TI86001171	BNL-NUREG—36988
TI86001189	BNL-NUREG—36989
TI86001190	BNL-NUREG—36986
TI86001199	BNL-NUREG—37005
TI86001200	BNL-NUREG—37004
TI86001821	NUREG/CR—4292
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TI86002819	PNL-SA—13423
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TI86003231	EGG-M—24585
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TI86004130	EGG-NTA—7097
TI86004131	EGG-NTA—7094
TI86004143	EGG-RTH—7064
TI86004147	EGG-REQ—7074
TI86004275	SAND—85-1666C
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TI86004714	NUREG/CR—4400
TI86004715	NUREG/CR—4189
TI86004757	NUREG/CR—4340-1
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TI86005112	NUREG/CR—4378
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TI86005351	EGG-EA—6422-Rev.1
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TI86900512	NUREG—0750-Vol.22-Index1
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TI86920093	EPRI-NP—4350
TI86920095	EPRI-NP—4307
TI86920096	EPRI-NP—4317
TI86920098	EPRI-NP—4346
TI86920099	EPRI-CS—4329-SR
TI86920100	EPRI-EM—4217
TI86920110	EPRI-EL—4152-Vol.3
TI86920111	EPRI-EL—4381-Vol.1
TI86920112	EPRI-EL—4381-Vol.2
TI86920113	EPRI-EL—4376
TI86920115	EPRI-EM—4389
TI86920121	EPRI-AP—4378
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SZ Swaziland

TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

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UG Uganda
US United States of America (USA)
UY Uruguay

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VE Venezuela
VI Virgin Islands of the United States
VN Viet Nam

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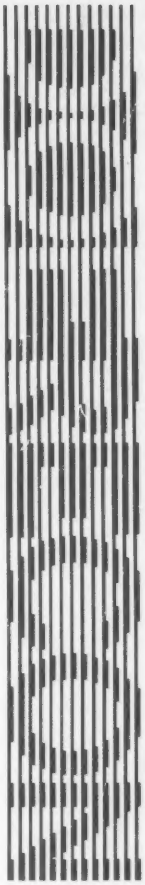

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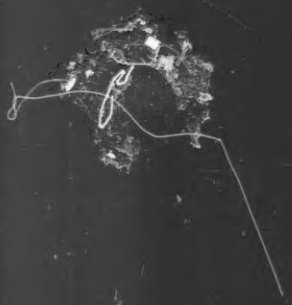
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